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Glory-Hole Mining at Fresnillo, Mexico

By Thomas C. Baker

Assistant to General Manager, The Mexican Corporation

A method that has given a total operating expense of 22.6 cents per ton and that necessitates only a small investment for an output of 3,500 tons per day. Hitherto unpublished details of the work are included

Secretary Mellon's Tax Plan and Mine Depletion

By Robert Murray Haig

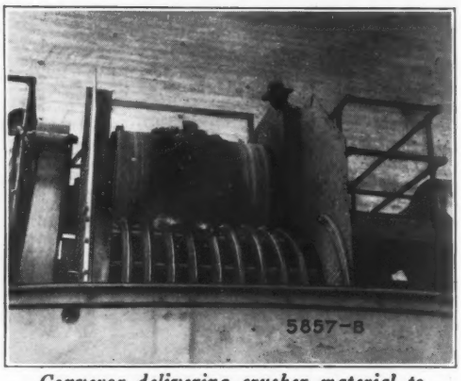
Suggested changes in Federal taxation are of importance to mining companies and personnel

How and Why Anaconda Helps the Small Operator

An Interview with C. F. Kelley

An unusual plan, but sound. As a large purchaser of custom lead, zinc and copper ores, the company realizes that its prosperity will increase with the development of new ore in old mines as well as in new ones

Activities of the Silver Committee in New York — Analysis of the Zinc Market



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BURCH Grizzly

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The Gold Miner's Marketing Problem

THE MARKETING PROBLEM of the gold producer is an absorbing one, like all marketing problems of all producers. The producer of copper or of lead has his most watchful observation concentrated on the market price of his metal, and his most anxious forethought is whether it will go up or down. The gold producer appears to have this difference: he seems to have no marketing problem; the price of his commodity remains staple, the demand unlimited, the market unbreakable. He needs no selling organization; he keeps no unsold stocks on hand. This difference has been esteemed by gold miners a great advantage when the gold mines pay profits; at other times, when the mines pay with difficulty or not at all, a great disadvantage, which he immediately exaggerates into calling a great injustice.

In this embarrassment, in which he found himself directly after the war, and in which he finds himself to a less degree now, he chafes because the hope of a higher price for the product is apparently forever denied him. Copper producers, he argues, may hope for a higher price, even though hope deferred maketh their hearts sick; and silver producers may hope that in one way or another dollar silver may come back; but he looks forward to a stale, non-stimulating flat level of $20.67 per ounce. Is it any wonder that he complains that he is cheated out of the universal gambling thrill; that he never had a chance anyhow; and that he should seek for means to better his condition?

What can he do? In the first place he cannot change the price of gold. It is not a fixed price, however, as he imagines; it is a fixed series of numerals only, and these numerals are fixed only because gold at this nominal figure per ounce has been adopted as the medium of buying and selling all commodities. The actual price of gold is the amount of commodities it will buy—of wheat, powder, labor, superintendents, use of capital, mining machinery, and rubber boots; and these amounts continually fluctuate, thereby revealing the fact of the very unstable value of an ounce of gold. Therefore, since the nominal figure for gold is not an index of its value, but is an innocent quotation on which the whole financial and industrial system is constructed, he cannot expect the government to disturb it, by increasing the price of gold arbitrarily, or by legislation designed to alter the price. And if the government were ignorant enough to do this, it would do the miner no good, for the prices of all other things which are measured in gold would at once adjust themselves accordingly; his costs would rise in more or less direct proportion to the increase in the price of his product, and his relative profit or loss would remain substantially unchanged.

Again, gold miners have complained of the amount of gold used in the arts—especially that used for jewelry—and of the ability of jewelers to buy gold at $20.67 per oz. from the United States Government; whereas, they argue if the government declined to part with its gold for use in jewelry, the gold miners might sell to the jewelers at a higher figure than the fixed quotation. But the United States Government, being on a gold standard, which is absolutely based upon the government's ability and willingness to exchange at any time a gold coin or a gold note, or any other obligation due and payable in gold, for the unstamped metal of equal weight, must carry out this transaction whenever called upon to do so. The value of gold as a standard depends primarily upon the fact that it is of real value, and its uses in industry and the arts are a constant affirmation and proof of that intrinsic worth. Therefore, it would be unwise for the miners to be unfavorable to the use of gold in jewelry; and the transfer of bullion to the jewelers from the mints is in effect the same as the passing out of gold coin in redemption of gold notes, as agreed; for the gold is weight for weight, whether coined or uncoined; only it is passed out uncoined, that it may be melted down, and thus avoid the melting down of gold coins, which, indeed, the government has forbidden, since it disturbs the gold basis for outstanding currency.

Can the gold miner, then, do anything? Yes: he can raise the real price of gold by favoring measures which will increase its buying power. The campaign of the gold miner should be, therefore, identical with that of the citizen who is out against the H. C. L.—the high cost of living. He will be a free trader, since all tariffs are designed to heighten internal price levels; although in this attitude he will run counter to the real or fancied interests of some other groups of miners. The tariff increases internal commodity price quotations, and therefore decreases the price the miner gets for his ounce of gold. Excessive governmental expenditures, whether derived from direct taxation or the payment of interest on bond issues, increase the price of commodities in gold, and decrease the price of gold in commodities. The soldier bonus is accordingly a formidable enemy of the gold miner. Inflation of the currency by any means, resulting in an increase in the circulating supply of money, whether currency or bank loans, is an enemy of the miner: for as the outstanding supply of money, relative to the outstanding amount of goods to be bought and sold, increases, its purchasing power decreases; and the miner's ounce of gold will less and less suffice to pay for the cost of producing that ounce, till he may be forced to quit the game. He does not rise more or less on the tide of inflation, like other producers; but, then, neither does he sink in the hard times of deflation, as the rest do. Therefore the interest of the gold miner will not be at all in the amount of gold in the government reserve, but in the ratio of paper currency and bank credit erected on these gold reserves. If the ratio of gold to all money (including bank credit) remains as at present in the United States,

where the gold basis is about one-seventh of the whole, then the gold miners' situation would not be improved with enlargement of the reserves; it would, indeed be changed for the worse, since the relative increase in the supply of money, if unattended by a corresponding increase in the volume of trade, would raise the commodity price level, and decrease the real value of his gold ounce.

The problem of the gold miner, then, is simply to lower costs. In his attitude toward governmental policies, we have indicated above what side will be for his interest. And, in addition, he should not forget the reduction of his local costs, through greater economy, better management, and higher technical skill. And this he can accomplish in many cases with less waiting and more surely. It is easier to stir your own stumps than to move all the nation, for the nation is built up of conflicting interests, and governmental policies represent a complex compromise of all, tending not to favor the gold miner but to give the greatest advantage to the greatest number.

Where Fake Promotions Lead—Sometimes

MEMORIES of past glorious moments must have come to Doctor Cook the other day as he stood before Federal Judge Killits in Fort Worth, while the latter was sentencing him to fourteen years in prison and a heavy fine for his part in the fraudulent oil promotions that have disgraced the State of Texas within the last few years. The happy phrases spoken to him years ago in Copenhagen when the populace hailed him as the discoverer of the North Pole, as well as the felicitations heaped upon him when he claimed to have conquered Mount McKinley—all these must have made a hideous contrast in his mind with the verbal tar and feathers that Judge Killits bestowed upon him as a preliminary to passing sentence. It was a great moment, however, to those who for years past have watched with helpless disgust this crook and others like him fleece the ignorant poor of their savings.

Equally gratifying, if not more so, was the sentence of eight years in prison and $8,000 fine given the notorious S. E. J. Cox, who has flooded the Southwest in the last five years with his lurid literature, advertising his fake oil and potash promotion schemes. It was at a comparatively recent date that Doctor Cook came into the limelight in his new rôle in Texas, but it seems as if we had had this triple-initialed Cox with us always. It is likely that their sentences will stick. Federal sentences usually do.

Anaconda's Co-operation

DEPARTING from custom, but nevertheless economically sound, and certainly commendable, seems the policy of the Anaconda Copper company of assisting and co-operating with the operator of the small mine. Elsewhere in the issue Mr. C. F. Kelley, president of the company, explains the method of, and reasons for, giving technical advice and other assistance. It may not be wise, but it is nevertheless true, that most individuals or small companies with slender resources feel that their money is better spent in more or less blind digging than in employing high-priced specialists to study the structural geology of their ground and advise where lies the best chance for finding ore. Whether they are right or not, they generally feel that they cannot afford the luxury of a $50-per-day man, and they seldom employ one. It was primarily to prevent the waste of money for badly planned development work that the Anaconda company made the offer to supply geological advice to small operators in the territory served by its custom reduction works.

But the scheme is not by any means a mere philanthropic undertaking. The company is in business to make money, not to help mine operators just because they happen to be honest and deserving and perhaps short of money. As Mr. Kelley explains, the prosperity of the smelting industry is directly dependent on the prosperity of the miner. Big mines all start as small ones, but the small one frequently dies in infancy when it could be saved by a correct diagnosis of its case and a little well-directed treatment. That is what Anaconda is anxious to supply.

Besides giving geological advice the company has helped finance small operations on terms which a conservative banker could not entertain; it has helped in the solution of metallurgical problems; and has made favorable smelting rates when a shutdown faced a producer. These things it has done without imposing conditions or attaching strings of any kind. The company wants the good will of the mining industry and believes that friendly co-operation will get it.

Canadian Gold Mines Receive a Boost

THE DOMINION GOVERNMENT recently announced that, pending further inquiry into the question of enforcing the gold embargo, licenses would be granted to Canadian mining companies allowing them to export newly mined gold bullion. This is doubtless welcome news to our Canadian gold-mining friends. They are now in the same position as fellow producers in South Africa, who also have the privilege of selling their output in the world market. By doing so British gold producers have a peculiar advantage, to which we have called attention many times in these pages. They can sell their gold to the United States, for example, receiving $20 and a fraction for each ounce sold. These dollars can then be converted into depreciated paper currency of the realm, either pounds sterling or Canadian dollars.

When an embargo is in force, as it has been in Canada, gold producers can only exchange their bullion legally for their own depreciated paper currency. In other words, the Canadian miner could obtain $20 plus a fraction, in Canadian paper dollars, which, according to present foreign exchange quotations, have depreciated about 2⅛ per cent in value. Under the new regulation of the Canadian Government, the local gold producers can now get American dollars for their output. The saving that this means to the Canadian producers is obvious. Take the case of Canada's largest gold-mining company, the Hollinger, which has a production of say $12,000,000 in gold annually. Assuming that the average depreciation of Canadian currency amounts to 1½ per cent for a year (for a short time exchange was at par) the company can save $180,000 in exchange by exporting its production to the United States.

The shipments of gold to this country will have the tendency of restoring the parity of exchange, a highly desirable procedure. In fact, some authorities maintain that embargoes on the free movements of gold from country to country should never have been established: instead, economic forces should have been given free play at all times.

The Doodle Bug Again

THE EVERLASTING SEARCH for the easy way to get gold and silver and precious stones from the earth without sweat and without intelligence continues unceasingly. Many such earnest seekers already have their own private divining rod, or other contraption for finding tin or nickel lodes in their respective cow pastures. But still there are others who would be obliged if they could be supplied. The following letter was received by one of our friends:

"Dear Sir:

"I was enformed that you was the main man of the Mining Engineers and wish that you should enform me where that I could get a miners Needle that will draw gold, Silver and Iron under ground where it is burried and if you hav Eny please let me know rite off and if you havent eny wish you would tell me where I could get one and be ever so mutch obliged."

Cyanidation and the Poison Hazard

IN SPITE OF THE DEADLY NATURE of the solvent used, the application of the cyanide process has been attended with remarkably few fatalities by poisoning. The record is all the more noteworthy because the exigencies of the situation necessitated the application of the process in many isolated districts, where medical help is usually unavailable, where the workmen are usually ignorant of the effect of poisons, and, despite repeated admonitions to caution, are exceedingly careless in handling them. This carelessness has been engendered by the circumstance that certain individuals are immune from the distressing sequence to absorption through the skin of working solution—cyanide rash—which makes life a misery to those who are constitutionally inclined to react thus.

Though mill men are constantly exposed to the poison, and in spite of their unavoidably close proximity to solution and gas, accidents have been rare. And the hazard is death. The action of the poison is quick and complete. On the other hand, recovery is likewise quick and complete if steps be taken promptly to avert a tragedy and if no more poison than can be completely neutralized has been taken into the system. One of the fundamental features of the MacArthur-Forrest claim was the weakness of the cyanide solutions used in practice—a circumstance that has helped to reduce the poison hazard, permitting the successful application of an antidote after most accidents of this nature.

The importance of a scientific appreciation of the effect of the poison and the need for definite information on the value of the antidotes available led to an investigation being made in Australia, in 1902, by Dr. C. J. Martin, at the instigation of the government of the colony of Victoria. The result of this research proved the worthlessness of several alleged antidotes and demonstrated the efficacy of ferric hydrate. The fact that this substance decomposes rapidly under ordinary atmospheric conditions was recognized and its preparation immediately before use was recommended. The essential chemicals are ferrous sulphate and caustic potash; and ingenuity soon found means whereby the proper amount of each could be sealed in small glass tubes, to be broken instantaneously, in a cup provided with a strainer, when necessity arose The only additional equipment suggested was a mouth gag, funnel, and stomach tube, for use in the event of the victim being too far gone to be able to swallow.

It is safe to say that Martin's antidote has saved hundreds if not thousands of lives; and we stress this point in an effort to counteract a misconception that is current in some quarters, a misconception that may have been partly responsible for a tragedy which happened recently. Readers of the *Journal-Press* will recall a scholarly article by Sergio Bagnara in the July 14 issue, on grading analysis by hydrostatic separation, using heavy liquids for this purpose. The author, a chemist of reputation and promise, was engaged soon afterward on research in the laboratory of a cyanide-manufacturing company. His work necessitated the frequent measurement of weak cyanide solution by pipette; and, as happens not infrequently when a safety float instrument is not used, a small amount of the solution was inadvertently sucked into the mouth; a similar happening has occurred countless times in cyanide-plant operation. The danger in this particular instance may have been nil or negligible, for the immediate reaction is to spit out the solution; the nerves and muscles concerned with swallowing are not in play at the moment. As a safeguard against possible absorption of the poison into the system, the essential equipment for the administration of a dose of Martin's antidote should have been available for immediate use. Unfortunately it was not. Instead, Bagnara called to an assistant for a glass, into which he poured, as he thought, hydrogen peroxide—an inefficient antidote—from a labeled reagent bottle in front of him. It proved to contain strong cyanide solution, the substitution of one chemical for another being one of those unfortunate mishaps that serve as the final link in so many chains of untoward happenings. Bagnara gulped down the liquid before he realized its deadly nature, and almost immediately dropped dead.

The circumstances attending this unfortunate case are not likely to be duplicated in a hundred years; but the hazard of poisoning by cyanide will remain so long as the most promising hydrometallurgical method now known to science is used for the recovery of gold and silver from ore. Our chief reason for discussing this subject at length arose from the fact that one of the most important items of evidence given at the inquiry that followed Bagnara's death was the assertion that no antidote is of any value in the event of poisoning by cyanide, the action of which, it was claimed by the witness, is too prompt and too deadly. This may be true of strong cyanide, but it is not true of small amounts of solution of the composition used in practice.

The time has come when safety-first propaganda, having achieved so much in the protection of workers from moving machinery, may be carried into the control laboratory. In those instances where routine work includes the frequent titration of cyanide solution, safety pipettes are desirable. It may be well to insist upon their use. And, until more effective corrective measures are disclosed by research, the necessary equipment for the immediate administration of Martin's antidote should be available in all parts of plant and laboratory.

Anonymous Letters

WE RECEIVE every now and then an anonymous letter for publication. Such a one, from "A Mining Prospector," lies before us. He writes, "Please publish my first and only letter." We cannot publish letters the writers of which hide their identity. We do publish letters sometimes under a *nom de plume*, but only where the writer's real name is known to ourselves; and we do even this reluctantly.

How and Why Anaconda Helps the Operator of the Small Mine

An Interview with C. F. Kelley, President of the Anaconda Copper Mining Company

C. F. KELLEY

AMONG the multifarious activities of the Anaconda Copper Mining Co., the world's largest corporation engaged in the non-ferrous metal industry, is the operation of three smelters which purchase custom ores. These are the copper plants at Anaconda, in Montana, and at International, in Arizona, and the lead-copper smelter at Tooele, Utah. The company also purchases zinc ore and concentrate on a custom basis for treatment at its electrolytic plant at Great Falls. It was from the standpoint of the owner and operator of custom reduction works that C. F. Kelley, president of the company, spoke when an editor of the *Journal-Press* recently asked him about the work that Anaconda has been doing to assist the owners of small mines. Mr. Kelley, years ago, was a lawyer, but he has lived that down and talks with the directness of an engineer. He said:

"During the depression two years ago, when the Tooele smelter was shut down, I went out West to make a survey of the situation. Generally one of three things accounts for the shutting down of a once profitable mine: (1) it may actually be worked out; (2) changes in the character, though not necessarily the grade, of the available ore may have made profitable operations impossible because of complex metallurgical problems; or (3) the ore may be "lost"—that is, it has been cut off by faulting, and either funds have been exhausted or the operators have become discouraged as a consequence of ill-advised search for other oreshoots. We came to the conclusion that in a good many cases this last condition was the cause of the trouble. Our company has at Butte one of the best-trained geological staffs in existence, and work was slack at that time. Accordingly we made it known generally that we would send one of our men to examine the structural geology of any mine in our territory and advise the owners where to look for ore. No conditions of any kind were attached to the offer. A surprisingly large number of companies availed themselves of it, to their great advantage. In some instances we advanced money for development work, and our technical staff has assisted in solving problems in ore dressing without any charge."

Mr. Kelley then cited a number of companies that actually had been put on their feet as a result of the assistance rendered. Some of these had continued to ship regularly to competing smelters. This seemed rather surprising until Mr. Kelley explained the reasons for the policy.

"We have large sums of money tied up in these reduction plants, and we must keep them going at as near capacity as possible. Moreover, we need certain kinds of ore to flux the products of our own mines. Unless the miner is producing we cannot smelt economically. If we help increase the output of a mine and the ore goes to our competitor, at least the keenness of competition for other ore is lessened. At the same time, of course, we would rather get the ore ourselves, and in most cases we have done so. The information that our geologists get is valuable to us in that it keeps us posted on the present supplies and future possibilities of ore from various districts. We have made detailed examinations in every one of the western mining states. We consider the confidence and friendship of the small producer a great asset to the Anaconda company. A cardinal principle of ours is fair dealing with the miner; we will not have a man in our employ who tries to gouge him. This policy on our part is not dictated by sentimental or altruistic motives. I am quite frank to admit that we consider it good business to give the operator of the small property just a little better than a square deal."

Secretary Mellon's Tax Plan and Mine Depletion

His Proposals Have an Important Bearing Upon the Welfare of the Mining Industries—Language Vague as to Rate on Earned Incomes

By Robert Murray Haig
Professor, School of Business, Columbia University

IT WILL BE RECALLED that according to the poet, Lady Godiva "Took the tax away, and built herself an everlasting name." In his letter to Representative Green, Secretary Mellon has made his bid for immortality. The only sure road to the taxpayers' eternal gratitude is through the abolition of taxes. Blessed is the Secretary of the Treasury to whose lot it falls to recommend reductions instead of increases!

Presening the Bill in Advance

Through a combination of fortunate circumstances, the Treasury shows a sufficient surplus to justify a radical cut in income tax rates. The Secretary, well in advance of the meeting of Congress, tells each individual taxpayer precisely what reduction he may expect in his tax bill for next year—if Congress does not pass the bonus. The $5,000 man notes that in place of last year's $68, he may be asked to pay only $38.25, enough to meet the increase in his coal bill. The $10,000 man sees his $456 tax shrinking to $234, saving enough to pay his life insurance premiums. The worried Congressman tries to decide whether the tax payers want the reductions more than the soldiers want the bonus, and, having promised the bonus, wishes to heaven the Secretary had not been so specific in his letter. If he had only restricted himself to talk about rates and had refrained from translating rates into dollars of individual taxes! To the Congressman who is pledged to the bonus, this is very bad politics indeed. He sees the possibility that the Secretary may be building himself an everlasting name—but building it indeed upon the blasted ambitions of Congressmen, who guessed wrong regarding the question posed above.

From the broad political point of view, there can be no doubt regarding the value of the Secretary's letter. It will aid very materially in securing a sound decision as to what the country really wants in the way of bonus legislation. He presents the bill in advance in a fashion which makes it much more easy to judge relative values. He appears to suspect that many of us who favor the bonus so long as we trust that it will be paid by the millionaires may change our views when we are told that, for many years to come, it will cost us exactly $29.75 per year out of our $5,000 salaries. Moreover, having been served with this definite notice, we may be expected to turn with a certain amount of scepticism to the words of ex-Secretary of the Treasury MacAdoo, who, in announcing his willingness to become President of the United States, assures us that we may eat our cake and have it too. We still feel after reading his words that, if we eat the cake, the baker will be sure to turn up with a bill for about $29.75 per year.

Shall Deductions for Depletion Be Abolished?

In the feeling of enthusiasm for the political sagacity of the Secretary, and for the proposed reductions in tax rates, there is danger that the suggestions which are urged in the letter regarding changes in the character of the revenue act will receive less analysis than they deserve. Most of these suggestions are excellent. There is one, however, of very vital importance to the mining industry, and which appears worthy of very particular attention.

Tucked away in the paragraph which recommends that deductions for capital losses be restricted to 12½ per cent of the loss—a suggestion which is obviously fair so long as capital gains are taxed at that rate as a maximum—appears the following sentences:

"It is believed it would be sounder taxation policy generally not to recognize either capital gain or capital loss for purposes of income tax. This is the policy adopted in practically all other countries having income tax laws, but it has not been the policy in the United States. In all probability, more income has been lost to the government by permitting the deduction of capital losses than has been realized by including capital gain as income."

When the full import of these sentences is realized, they give rise to a feeling of amazement. Does the Secretary really mean to say that, if he were to have his way, a dollar of profit from the sale of an appreciating asset shall go entirely untaxed, when, in the same letter, he quite properly urges special leniency for "earned" as compared with "unearned" income? Does he in this casual manner propose, as is clearly to be inferred, that capital items such as deductions for depletion, should hereafter be disallowed? It would appear that with respect to this subject the Secretary has been poorly advised.

Do Capital Gains Exceed Capital Losses?

The Secretary's surmise that the deduction of capital losses has cost the Treasury money, even if true, which is doubtful, may be explained on various grounds which are of only temporary significance. The absence of the limitation to 12½ per cent which the Treasury proposes to introduce is one possible explanation. The Secretary proposes that this absence be remedied. In further explanation, it must be remembered that the country has been passing through a period of deflation in the course of which many values have been radically shaken down, but this is merely a passing incident in the history of the growth in the national wealth. Again, many owners of appreciating assets have postponed realization in the hope that something of the character which the Secretary suggests would happen which would enable them to pocket their profits without parting with part of them in taxes. In connection with this last situation, it is interesting to read the Secretary's general recommendation that "In addition to the specific recommendations which directly affect Government revenues, there should be amendments to strengthen the act and eliminate methods heretofore used by taxpayers to avoid imposition of the tax." To ignore capital gains and losses is a strange way to accomplish this end.

But is it true that, taking it by and large, capital losses exceed capital gains? J. P. Morgan is credited

with the observation that "The man is a fool who is a bear on the future of the United States." All the statistical evidence supports him in his statement. It shows enormous increases in our national wealth. Many, perhaps most of the great fortunes in this country, arise from the appreciation in the value of skillfully selected properties. Irrespective of the Treasury's experience during the years of this post-war readjustment, the net appreciation in the value of our various properties is an item which may be lightly written out of the definition of taxable income on the ground that it is of negligible or even negative significance.

The suggestion that capital gains and losses be stricken out of the computation of net income is based upon a definition of income so narrow as to be quite unsatisfactory under conditions like those which exist in this country. It would lead to inequitable and ridiculous practical results. To say that a man who buys a 4 per cent bond and a year later collects his $40 coupon and sells the bond at a price yielding him a $40 profit has received income of only $40, and not $80, is repellant to the common sense of most economists, accountants, and business men. If the $40 of interest is to be taxed as income, the $40 of profit should certainly be subjected to a tax of the same weight. Otherwise, indeed, the Treasury encourages everyone to favor investments of low current yield and high rates of appreciation in value.

Foreign Practice Not Conclusive

The Secretary's appeal to foreign practice seems to be particularly unfortunate. There are, indeed, many respects in which this country might study and copy the income tax policies of other countries, but the Secretary appears to have chosen one of the few respects in which the federal practice is definitely superior to that which obtains abroad.

Informed students are aware that income taxes abroad are practically all framed in imitation of the British system. It is true, further, that the British system, considered historically, has tended to restrict itself to current items and to ignore capital gains and losses. But it is also true that this policy has created a tangle so serious in character as to befuddle very thoroughly both the courts and the Inland Revenue and that it led in the case of the British Excess Profits Duty to the virtual abandonment of the traditional concept of income as used for income tax purposes. Not taxing capital gains, the British for a very long period quite logically declined to recognize deductions for depreciation and depletion. Some time ago logic was abandoned to the extent of allowing depreciation, and only recently the Royal Commission on the Income Tax has recommended a very limited deduction for depletion. In the Excess Profits Duty, the officials discovered that it was easy for taxpayers to spend income in such a manner as to increase the value of capital assets and then sell the assets and report no taxable income. In the case of ships and in the case of the Scotch distillers, for example, special measures had to be taken to prevent widespread evasion by this method. Moreover, the English courts have been placed in the uncomfortable position of having to decide that the profit on a given sale of property was or was not income depending upon *the intention in the taxpayer's mind* when he acquired the property. If he intended to sell the property when he acquired it, for gain, the profit was income; if not, the profit was not income! Indeed the whole trend in England appears to be away from the narrow traditional definition of income and directly toward the concept accepted in the American law. To adopt the British policy on this point would solve the problem before the Treasury only by raising much more serious and difficult ones. It is safe to say that the British concept logically applied would arouse very little enthusiasm in the mining industry.

Shall Corporations Become Partnerships?

The Secretary's letter is noticeably silent on another very important problem. At present corporations are taxed 12½ per cent, stockholders receiving an offset so far as their normal tax of 8 and 4 per cent is concerned on such dividends as are declared. The Secretary recommends that the normal tax be cut to 6 and 3 per cent, but apparently plans to leave the corporation rate at 12½ per cent. This is a much more radical discrimination against the corporate form of organization than has obtained before. Will it not stimulate many corporations to reorganize as partnerships, especially in view of the low surtax rates recommended to apply to the distributive shares of partnership profits?

The Secretary is to be congratulated upon his suggestion for a lower rate on earned incomes. However, his language is uncomfortably vague. How does he suggest that the vexed question of business profits of unincorporated concerns be solved? Is the salary of a corporation officer to be considered earned and the profit of a partner to be considered "unearned"? Until some practicable method can be evolved for answering this question, the recommendation has slight chance of being enacted into law.

Although attention should be called to such points as these, it should be remembered that the primary purpose of the Secretary's letter was undoubtedly to confound the proponents of the bonus, which purpose it promises to accomplish. Perhaps the Secretary has a real defence for his suggestion that capital gains and losses should be entirely disregarded. Perhaps he intends to suggest a cut in the 12½ per cent tax on corporations, but deems the time not ripe for the announcement of his intentions. Perhaps he knows how to define "earned" income satisfactorily, and will later present a workable plan. In the meantime let everyone rejoice that the administration possesses a shrewd financial leader and hope that he achieves the immortality he so richly deserves.

Distribution of Austrian Magnesite

The distribution of Austrian magnesite exports, according to *Commerce Reports*, affords some interesting indications of the relative activity of the metallurgical industry of different countries in recent months. According to statistics furnished by the Veitscher Magnesite Co., the largest producers of this commodity in Austria, the percentage of that company's sales to the United States in the period from July 1 to Dec. 1, 1922, was 43.25, and from Jan. 1 to May 1, 1923, 44.81.

Of shipments going to other countries than the United States, France, Hungary, Spain, Scandinavia, Finland, Poland, Rumania, and British India registered decreases. England, Czechoslovakia, Yugoslavia, Italy, Switzerland, Brazil, and Chile, on the other hand, showed increases.

Fresnillo Glory-hole Mining Practice

*Details and Costs of the Mexican Corporation's Operation in Zacatecas**

By Thomas C. Baker
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THE FRESNILLO UNIT of the Mexican Corporation, S. A., is situated at the old historic mining town of Fresnillo, Zacatecas, Mexico, 33 miles north of the city of Zacatecas and 750 miles south of El Paso, Tex. It is connected with the Mexican Central Railroad by a broad-gage spur, 5.5 miles long, belonging to the company.

Fresnillo is surrounded by a broad semi-arid valley on the Mexican plateau at an elevation of 7,300 ft. The monotony of the valley is broken by a number of low hills. Near the town of Fresnillo is the "Cerro de Proaño," an elliptical-shaped hill of gentle slope, rising out of the plain to a height of 325 ft., and having a base with major axis 4,500 ft. long and minor axis 3,000 ft. long. In this hill is a great silver-bearing mineralized zone, which comprises past and present mining operations.

In the following paragraphs, money values and tonnage figures are expressed throughout in American currency and the dry short ton of 2,000 lb. respectively.

The discovery of ore at Fresnillo is credited to the Spaniards, soon after the conquest of Mexico. There are, however, no authentic records to show the amount of work done by them. In 1832, the State of Zacatecas took possession of the property, and operated it for its own account. Evidently the rich ore above the horizon of the plain had been fairly well exhausted, as an old record states that thirty shafts were used for unwatering, requiring 300 men and 1,500 animals. The cost of pumping alone amounted to $150,000 a year. In spite of the fact that cheap convict labor was used, mining costs were reported as $20 and treatment charges as $20 per ton.

In 1835, the state was obliged to seek foreign capital, and a new company was formed in London, which secured a controlling interest in the property. This new organization sunk two large shafts, one 11x19 ft. and the other 10x15 ft., to unwater the mines and extract ore. Large Cornish pumps were purchased in England, and hauled overland from Vera Cruz. Similarly engines were installed to operate the arrastres (grinding mills) in the patio process of ore treatment. Fine substantial buildings were erected and operations were conducted on a large scale for that period. The patio, the largest in Mexico, was 1,150 ft. square. An old record shows the following costs for the year 1850:

	Per Ton
Mining	$4.86
Pumping	1.35
General	1.28
Treatment	4.64
Total	$12.13

From 1857 to 1867 Mexico was torn by civil strife, followed by the French occupation and unsettled conditions. During this period the water was allowed to rise in the mine, operations retreating upward with the water level. The greatest depth that had been reached was 1,400 ft. below the plain.

*Photographs accompanying this article have been crowded out of this issue, and will be published separately next week.

From 1857 to 1903, mining was carried on in a desultory way, and with one exception—when an unsuccessful attempt was made to unwater the mine—was confined to robbing pillars above the permanent water-level and resorting old dumps on the Proaño hill.

Old Tailings Indicative of Past Operations

That a vast amount of mining has been done in the past is evidenced by the large tonnages of old tailings from the patio process and of dumps left behind. Of the former 2,000,000 tons was reclaimed for re-treatment by lixiviation. The dumps contained 300,000 tons of low-grade ore.

In 1900, the Fresnillo company acquired a large part of the tailings and erected a lixiviation plant for their treatment. In 1910 the company extended its holdings to the mine. A 500-ton cyanide plant was partly constructed in 1911-1912 to treat low-grade ore in the Proaño hill. Power for the mill was generated in a gas-engine plant. The company was forced to suspend operations in 1913 as the result of the activities of different revolutionary factions and bandits in the State of Zacatecas. This shutdown lasted until January, 1919.

In November, 1919, the Mexican Corporation, S. A., obtained a long-term lease on the property, in return for which it agreed to construct a cyanide plant having a capacity of 2,200 tons daily, with a power plant of adequate size, and to provide other necessary equipment.

Geology Described by Arenas in 1859

At the foot of the Proaño hill there stands today a large and handsome building, which was the home of the National School of Mines of Mexico from 1854 until 1859. Pascual Arenas, professor of mining in this school, wrote in 1857 a monograph on the geology of the Fresnillo district and the Proaño mine. This report shows that the author was a keen observer and a geologist of unusual ability.

Fig. 1 is a copy of the map that accompanied the Arenas report. The multiplicity of the veins, the geologic structure, and the topography in the vicinity of the mine are well shown. This map has proved a valuable guide in planning development work, furnishing advance information which so far has been found reliable.

The regional formation is mainly sedimentary. A thinly laminated carbonaceous shale is conformably overlain by an irregularly bedded graywacke, the combined thickness of these two members amounting to more than 5,000 ft. Because of an almost complete lack of fossil remains, a definite correlation of these sediments presents considerable difficulty. They have, however, been tentatively classified as Devonian.

The shale-graywacke formation was subjected to a gentle folding, and later intruded in a scattered and irregular manner by small igneous masses of a medium-basic type. These isolated intrusions appear to be separate offshoots of a deep-seated central mass. A

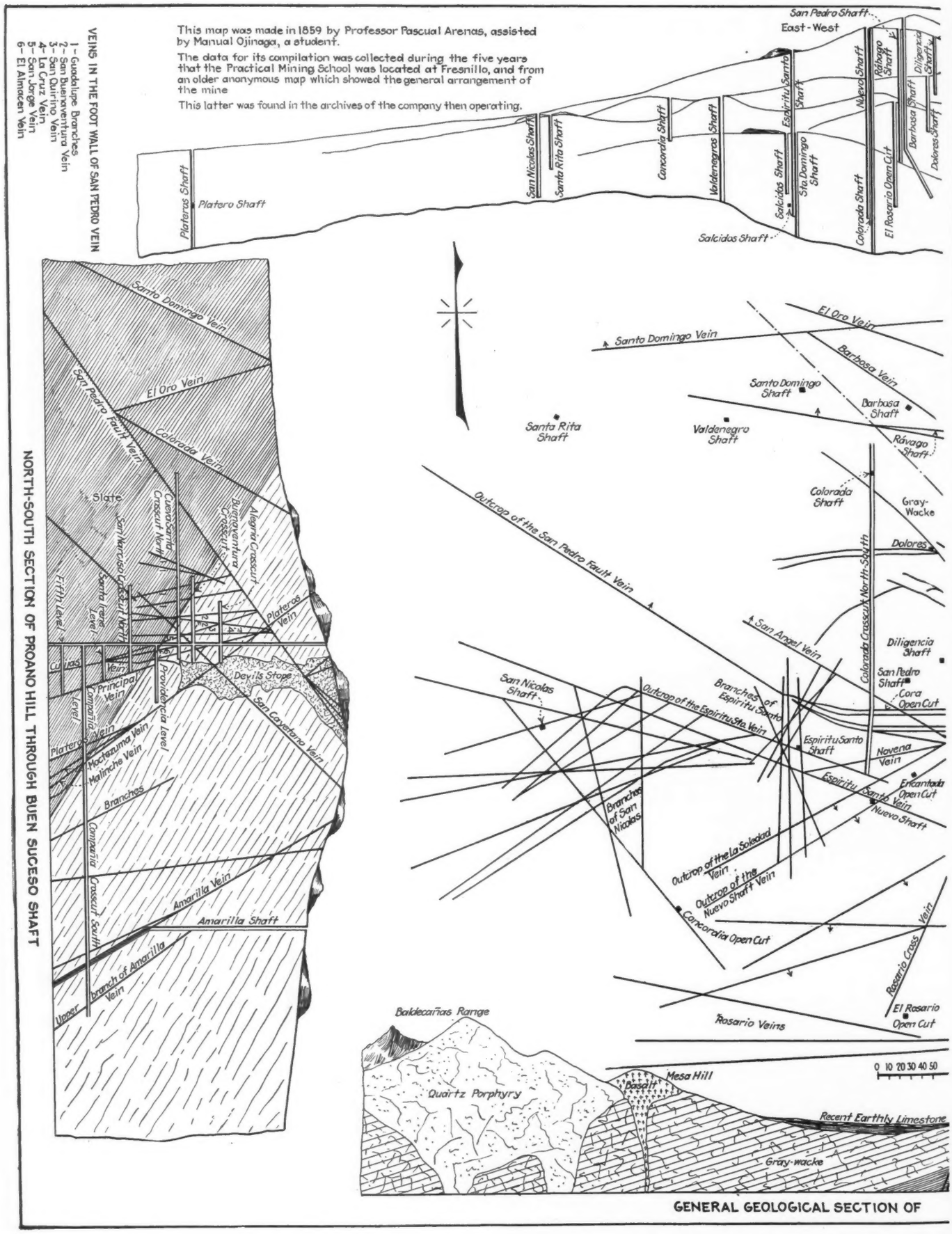
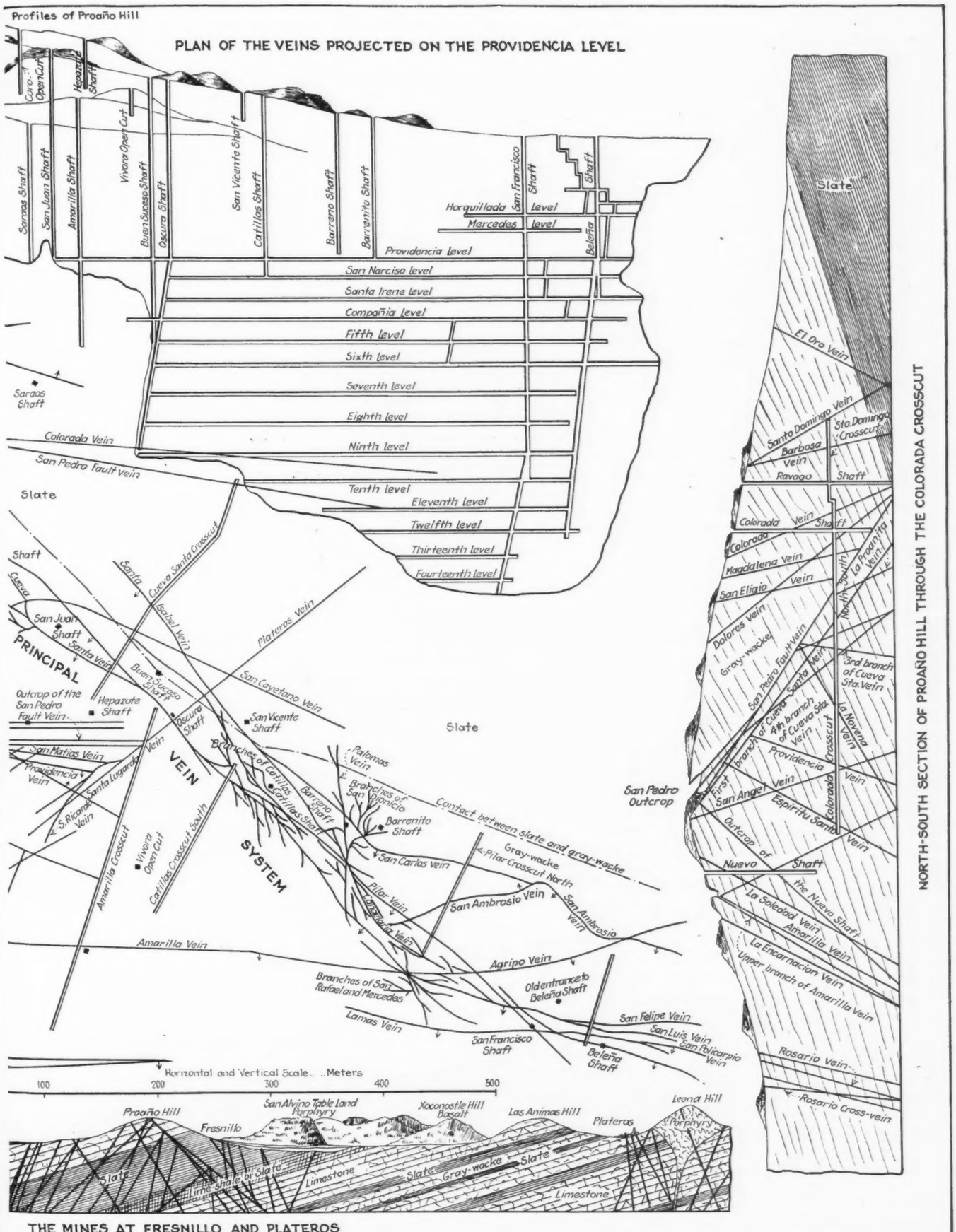


Fig. 1—Plan of the principal veins of the Fresnillo



THE MINES AT FRESNILLO AND PLATEROS

mines, with several sections of Proaño Hill

series of Tertiary flows, varying in composition from a trachyte to a basalt, later covered the country.

Subsequent erosion practically removed these flows, only isolated fragments remaining. It likewise stripped enough of the shale-graywacke formation to expose many of the isolated intrusions and wore these away, with one or two exceptions, to such an extent that they are no longer conspicuous.

The final stage was the deposition of a recent earthy limestone locally known as "caliche." This formation is unconformable with the underlying Devonian. The beds are practically horizontal and are 50 to 75 ft. thick, sufficient to conceal the older formations except where they rise above the plains as hills.

The mineralization of the district was effected in the Tertiary period, following the intrusions and preceding the appearance of the flows, and resulted probably from processes of magmatic differentiation within the mass of the deep-seated central intrusion.

Proaño hill is an outcrop of graywacke. Its elevation above the surrounding area was probably due to upward pressure exerted by the igneous intrusive. During this process the Devonian sediments were severely fractured.

Four general fracture systems resulted, within which are comprised all the structures of importance. In addition to the four main groups of fractures, and entirely subsidiary to them, there are found innumerable minor structures, many with strikes roughly paralleling the principal systems, others striking independently in every direction.

The area within which productive veins have been found is one mile long by one-half mile wide. The important units of each fracture system meet in the central portion of the hill where the rock was also intensely fractured by subsidiary movements, resulting in a shattered zone 1,200 ft. long by 400 ft. wide.

Mineralization Most Intense Along Lines of Main Fracture

The mineral solutions, rising along the main fracture planes, also entered the minor fractures and cracks in all their deviations. They not only precipitated their metallic contents along the fractures, but, owing to the mineralogical composition of the graywacke, effected replacement within the rock. The mineralization was more intense in the immediate vicinity of the principal channels through which these solutions rose. It was along the lines of this main fracture, therefore, that the ore was formed that attracted the attention of operators in the past.

The valuable metals are silver and gold, the ratio by weight of the former to the latter being 1,000 to 1.5. Argentite is the predominant silver mineral, and is associated with pyrite and manganese mineral. The sulphides are primary throughout. A slight secondary action is represented by small quantities of native silver and silver halides, principally cerargyrite, which are found in the upper part of the mine.

No zone of secondary sulphide enrichment is indicated at greater depth. There are, however, evidences that a zoning of primary sulphides will be found, and that argentite will gradually be replaced by primary lead and zinc sulphides.

Oxidation has penetrated with great thoroughness to the lowest horizon so far exposed, this being 420 ft. below the present ground water level.

The shattered mass within the central portion of the hill and near the surface was sufficiently mineralized by the processes described above to produce a large stockwork deposit, which, on account of conditions favorable to low mining costs, can today be profitably exploited.

The subsidiary fractures and cracks become less numerous in depth: likewise, the amount of valuable mineral deposited outside of the principal fracture systems. The transition from ore to unprofitable material varies as to depth in different parts of the deposit; on the average the bottom limit is 300 ft. below the summit of the hill. The principal vein systems, however, continue productive to the deepest level exposed to date.

In the case of the two most important veins, the mineralization was effected in their upper portions—not along a single plane of weakness but over a fairly wide fracture zone. The lateral limits of these zones are fixed by the degree of intensity of the subsidiary fracturing, there being no well-marked walls. The ore limits can be determined by sampling only.

At an elevation of 350 ft. below the local datum plane, which is 320 ft. below the summit of the hill, one of these veins has an average payable width of 45 ft., and the other a width of 36 ft. As further depth is reached, these mineralized fracture zones appear to be consolidating into formal veins of less width. The other veins now exposed are far more regular in character. They vary in width from 3 to 10 ft., and exhibit a comparative uniformity from the surface to the lowest point at which they have yet been observed, 525 ft. below the datum plane. The small proportion of the quartz in the ore is noteworthy.

So far as known, the pre-mineral faults are few and of little importance. The post-mineral movements are numerous and widespread, but, with one exception, they have not displaced the veins enough to interfere either with mining or development operations.

The ore extracted by the Fresnillo company and by the Mexican Corporation, S. A., until the end of 1920 was broken in quarries. The details of the method used were fully described by D. B. McAllister in the *Engineering and Mining Journal* of May 7, 1921. A résumé will be given to convey a general idea of the method used.

No mechanical power was available for mining operations; consequently more labor was required than would have been necessary otherwise.

The quarry faces were carried by benches 20 ft. high. Holes were spaced 6 to 10 ft. apart and along a line 6 to 10 ft. back. Double-hand drilling was employed for the first 5 ft. of a 20-ft. hole and hand churn drilling for the remainder. A pair of good miners working on contract would drill a hole in a shift.

The hole was chambered at the bottom, by successive springing, to hold the requisite quantity of explosive. After being allowed to cool, the chamber and about two-thirds of the hole were loaded with $\frac{7}{8}$ in., 40 per cent nitroglycerin, tamping thoroughly to obviate air spaces. The upper part of the hole was filled with stemming made of sand and clay. A No. 8-X blasting cap was placed about midway in the charge of dynamite and electric cap near the top. From four to ten holes were fired simultaneously by a blasting machine, all circuits being connected in series. Nitroglycerin dynamite, having a higher rate of detonation than the gelatin or ammonia dynamites, proved most economical, as less secondary blasting was required.

The ore had to pass through an 8-in. gyratory; pieces that were too large were reduced to the proper size on the quarry floors by block holing or by sledge hammers.

The broken ore was shoveled into a side-dump car having a capacity of 26 cu.ft. and trammed on a 20-in. gage track by two men to the mill bins. The main track, which was connected with each quarry, was half-way between the summit of the hill and the glory-hole haulageway.

Glory-hole mining has increased the dynamite consumption per ton of ore broken one-third over the average for quarry work, owing to the fact that straighter faces and higher benches can be carried in a quarry. The glory-hole system has, however, greatly reduced labor costs, as will be seen later.

The construction program of the Mexican Corporation was predicated upon the results of sampling the large, surficial ore deposit. At the time the property was acquired only the ore above the level of the plain was accessible for measurement and sampling. It was estimated that the orebody contained 5,000,000 tons of ore, averaging 5.25 oz. silver and $0.20 gold per ton. This would form the basis of future operations, with good chances of developing later substantial tonnages of ore in the underground mine.

The mill was originally built for a daily capacity of 2,200 tons, but it has been enlarged since then to treat 3,500 tons a day.

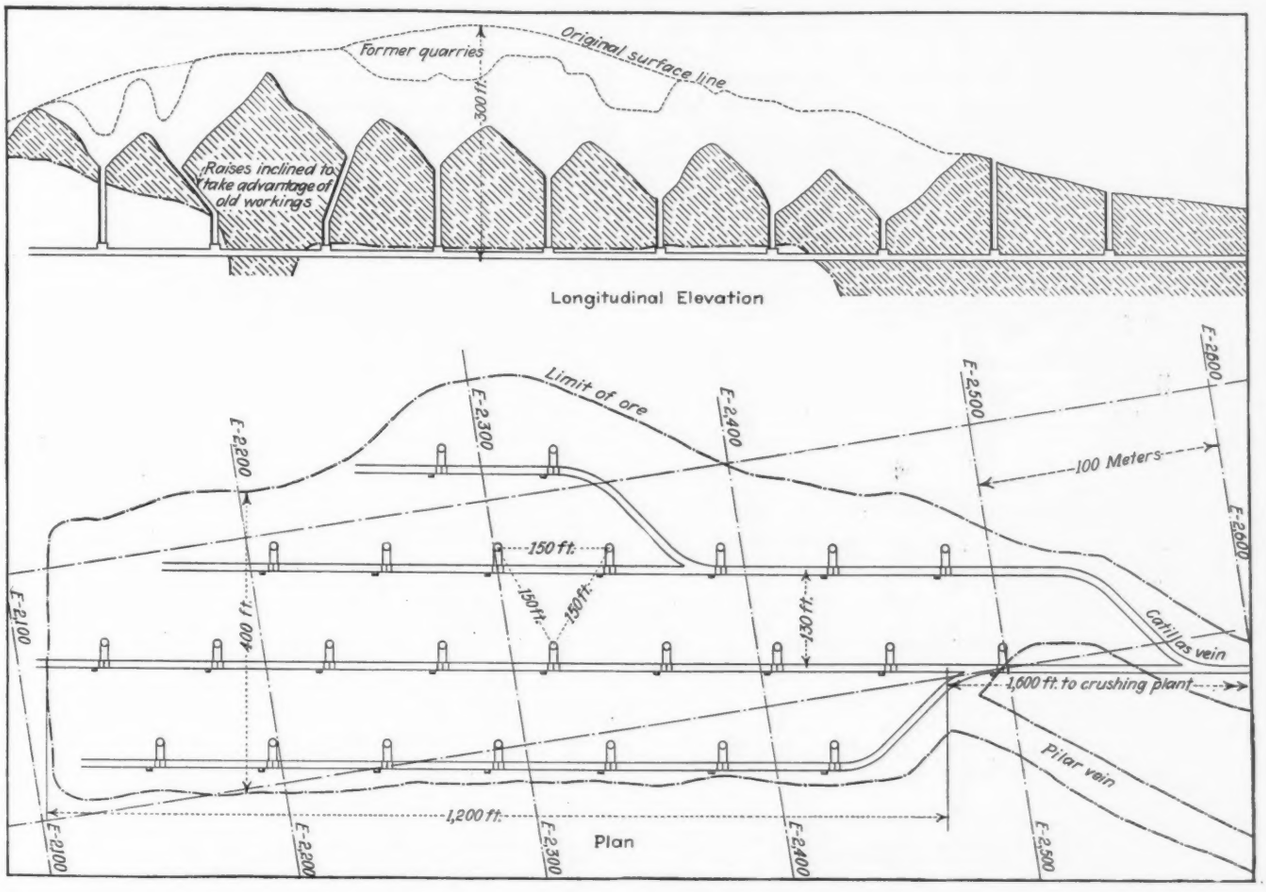


Fig. 2—Arrangement of haulageways and glory holes at Fresnillo

The average mining costs for 1920 are given below:

Quarry Costs

Ore Breaking:	Per Ton	
Drilling	$0.17	
Timbering	0.03	
Explosives	0.023	
Tracking	0.03	
Lighting	0.005	
Supervision and miscellaneous	0.04	
Total		$0.298
Quarry to mill bins		0.108
Surface		0.067
Total mining, excluding development		$0.473

Of the above $0.34 was for labor.

The average duty per man is given in the following table:

Total Tonnage, Month,	All Operations: Total No. Shifts	All Operations: Tons Per Man-Shift	Ore Breaking: Total No. Shifts	Ore Breaking: Tons Per Man-Shift
15,800	6,176	2.39	2,870	5.50

The average consumption of explosives is shown in the following tabulation:

Article	*Consumption Per Ton Ore*
40 per cent nitroglycerin dynamite	0.122 lb.
Blasting caps	0.091 caps.
Fuse	0.333 ft.

Glory-hole System Adopted After Careful Study

Open-cut mining with steam shovels was considered carefully before selecting the glory-hole method. The factors analyzed and the conclusions reached were as follows:

1. According to comparative estimates made, the cost of mining with steam shovels would be lower than by the glory-hole method. The indicated advantage in favor of the former was questioned, however, as the estimated margin was too small to be within the limits of accuracy of the data taken as bases for the calcula-

tions. This advantage was discounted further by the greater uncertainty attached to the steam-shovel estimate, owing to the absence of steam-shovel data applicable to this orebody.

2. The silver minerals were deposited throughout the ore deposit in a very irregular manner. Sampling had shown that portions of unprofitable material would be found. Whereas large blocks could be handled equally well by both methods, steam shoveling seemed to offer a better opportunity for the selective mining of small bunches than the glory-hole method.

3. The glory-hole method is an extremely simple operation and does not require any skilled labor, whereas experienced foreign shovel men and cranemen would be needed in steam shoveling, and a sure supply thereof could not be counted on.

the orebody. The distance from the portal to where it enters under the orebody is 450 ft. There it branches into parallel haulageways 130 ft. apart. The radius of each turnout is 100 ft. The standard haulageway section is 10 ft. wide by 9 ft. 6 in. high. Except at the loading chutes, little timber is used.

Fig. 2 shows the arrangement of the haulageways with respect to the orebody.

Loading Stations 150 Ft. Apart

Along each haulageway, loading stations are spaced at intervals of 150 ft. To provide room for the timbering, the back of the drift is first raised to a height of 17 ft. above the rail and for a length of 14 ft. A pilot raise, around which the loading pocket is subsequently stoped, is then driven high enough so that the

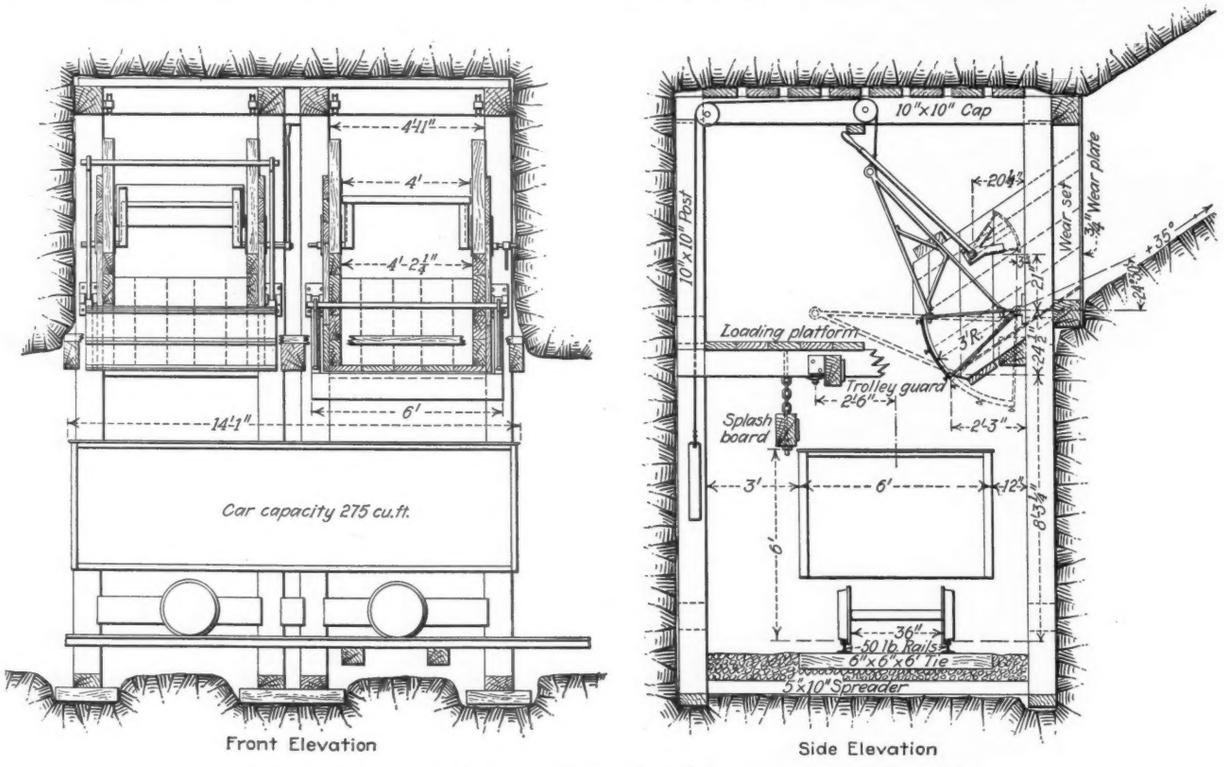


Fig. 3—Loading chute used in glory-hole practice at Fresnillo

4. A reserve of 10,000 tons of broken ore could be carried in the glory holes to insure continuous milling operations at full capacity. On account of the low cost, the interest charge on the money represented in breaking this ore would be inconsequential.

On the other hand, reductions in the milling rate might follow serious accidents to steam shovels or to the haulage equipment on steep grades and curves required. The mill has treated 1,600,000 tons of ore, and not once since it was started has any reduction in tonnage been necessary for lack of ore.

In reaching a conclusion, the advantages of the glory-hole method over steam-shovel mining were considered enough to outweigh the possible disadvantages.

Preparations Made to Install Glory-hole Methods

The haulageway system for the extraction of the ore was placed low enough to serve most of the ore deposit and at the same time leave enough of the hill slope below the portal for a suitable mill site. The adit is 2,200 ft. long and is parallel to the longitudinal axis of

station and chute timber can be placed without danger of being subsequently blasted.

Double chutes are built at each station, so that a car can be filled with one spotting, and in the event one chute becomes blocked by large boulders, loading can still be done from the other chute. Underswung, hand-operated arc gates are used in conjunction with radial check gates. Most of the control is secured by the latter, the underswung gate being used to start and stop the flow of rock. Without the check gate, the pressure on the underswung gate is enormous and manual operation thereof is almost impossible.

The operating platform is above the trolley line, which makes for safety and ease in loading the trains.

Fig. 3 shows details of the loading chute, which is similar to one used successfully at the Alaska Gastineau mine. The chute details and the relation of the underswung gate to the chute bottom have been modified somewhat since operations started. The gate works best when the chute bottom has a slope of 35 deg., and the arc is described as shown on the drawing. The

gate is overbalanced by a counterweight, so that the flow of ore is easily and quickly stopped; this requires a greater effort in opening, but permits a quick and positive cut-off.

The loading arrangements have proved successful, considering the fact that the ore varies in size from a good proportion of fines to a maximum of 30 in., such material being difficult of control with any type of chute. The underswung arc gate handles the large boulders relatively easily and with little spillage of the fine material.

Air cylinders for operating the gates were considered, but were not adopted for the following reasons:

1. Only three extra men per shift were required for the manual operated gates.

2. Air cylinders would always require a certain amount of upkeep, and are wasteful of air, especially when leaks are not promptly stopped.

3. During a temporary air shortage arising from compressor troubles or a break in the pipe line, loading operations would be at a standstill if dependent upon air cylinders for manipulation of the gates.

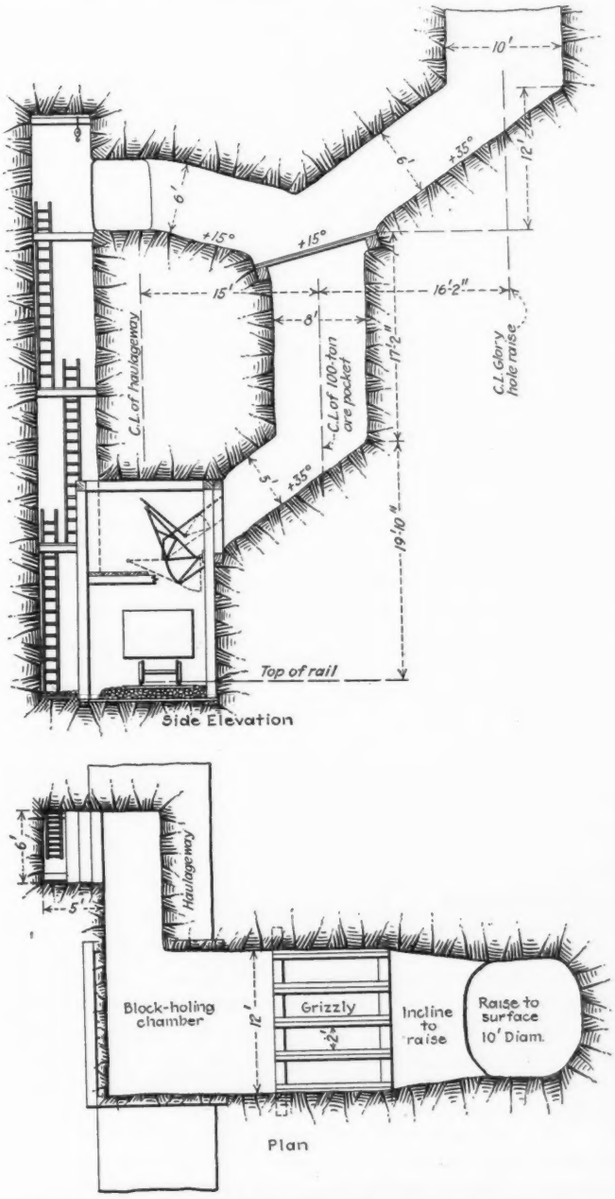


Fig. 4—Grizzly, block-holing chamber and ore pocket are seen in this sketch

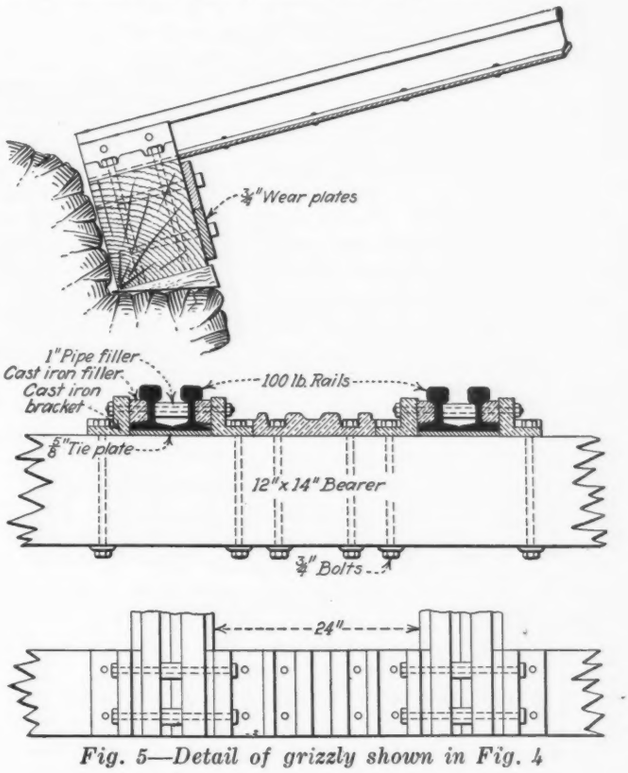


Fig. 5—Detail of grizzly shown in Fig. 4

After the loading station has been timbered and the loading chutes are completed, the pilot raise for the loading pocket is extended to a height of 35 ft., measured above the floor of the haulageway, and is then stoped out to provide storage for 100 tons of broken ore.

The grizzly is set directly over the loading pocket on an inclination of 15 deg. with the horizontal. The grizzly bars, each formed of two 100-lb. rails riveted to a 10-in. x ⅝-in. plate, are spaced 24 in. apart. Each bar can be removed separately and with ease, without disturbing the others. Credit for the design is given the New Jersey Zinc Co. For details of construction, see Figs. 4 and 5.

From the grizzly the main raise to the surface is driven at an angle of 35 deg. for a distance of 18 ft. before it is turned vertically. This is a desirable feature in the arrangement, as the ore falls on a rock-bottom incline and slides or rolls over the grizzly. The excavation above the grizzly chamber and the incline are so designed that the broken ore cannot flood the entire grizzly. The big boulders have a tendency to roll to the lower side, where they can be easily broken by block holing. The success of the design has been fully demonstrated by the ease in which the ore pockets are kept full and the lack of wear on the grizzly bars. As high as 2,000 tons of ore has been drawn from one loading station in twenty-four hours. To date only two bars out of ninety-five in service have been replaced. The maximum tonnage that has been handled so far by any one grizzly is 235,000 tons.

No timber is needed to support the ground in the loading pockets or raises. The vertical raise to the surface has a circular section, the diameter being 10 ft. Details of the ore pocket and grizzly arrangement are shown in Fig. 4.

Six feet from the loading station and on the opposite

side of the haulageway, a raise is driven from the track level to a point 10 ft. above the floor of a short sublevel connecting the raise with the block-holing chamber. Head room is thereby furnished for raising and lowering grizzly bars. A snatch block is hung at the top of the raise to facilitate the work. A good ladderway with landings at each ladder is built to provide easy access to the block-holing chamber. A clear space is left in each manway for hoisting the grizzly bars. A 1-in. pipe line is carried up to furnish air for drilling the large boulders.

The manway is offset from the block holing chamber by the short connecting drift, so that it is out of the way of flying rock when blasting. The floor of the block-holing chamber slopes down to the grizzly to stop large boulders rolling down the incline at or near the foot of the grizzly.

Table I—Average Cost Per Foot Advance

	Feet	Drilling	Timbering	Explosives	Loading and Tramming	Total Cost — Labor and Bosses	Supplies	Power	Total
Haulageways	5,026	$9.19	$2.58	$3.11	$3.74	$10.65	$6.18	$1.79	$18.62
Glory-hole raises	3,194	7.92	0.84	1.79	0.86	8.16	2.92	0.33	11.41
Ore-pocket inclines	1,337	10.34	3.89 (a)	1.74	0.91	11.52	14.78	0.58	26.88
Sub-levels and manways	1,074	4.99	2.18	0.54	0.69	5.91	2.19	0.30	8.40
Miscellaneous development	1,109	3.48	0.64	1.04	0.61	3.91	1.63	0.23	5.77
Tracking (5,026 ft.) (b)	.....	.....	.....	.....	.....	1.66	1.76	.....	3.42
Lighting carbide	.....	.....	.....	.....	.....	.....	0.38	.....	0.38
Totals and averages	11,740	$8.04	$3.18	$2.16	$2.05	$9.70	$6.62	$0.98	$17.30
Glory-hole loading station	19 stations	$29.22	$917.88 (c)	$20.38	$18.34	$336.99	$634.56	$14.27	$985.82

(a) Includes grizzlies and temporary timbering. (b) Rails and splicebars charged to equipment. (c) Includes iron work.
Tons ore recoverable by drawing only, 6,000,000
Total cost of preparatory work, $221,784.46
Cost per ton $0.0370

Low Benches Carried in Breaking Ore

The benches are 9 ft. high and the floors are kept as close to the horizontal as possible. Holes are spaced 3 ft. 6 in. to 4 ft. apart, and are drilled vertically from 3 ft. to 5 ft. from the face of the bench. This system of using comparatively shallow holes spaced fairly close has proved more economical than deep holes with heavy loads. The reasons are:

1. The ore is broken to better size, thereby reducing the expense of secondary blasting. Also glory-hole raises are less liable to be blocked with large boulders.

2. Holes can be drilled dry to a depth of 10 ft., whereas water machines and water lines would be required for deep holes. The water lines would not only be an added expense, but would prove a nuisance in the glory holes.

3. Labor for loading and blasting shallow holes is less per ton of ore broken.

4. Local machine men are more efficient in drilling short holes.

5. Less drill steel is broken and stuck with short holes; also, pieces are lighter and, therefore, more easily distributed to and collected from the working faces.

Deeper holes and wider spacing gave more tons per foot of hole drilled and a slightly lower powder consumption per ton broken, but the final results showed a saving in favor of the system used.

A slope angle of 50 to 60 deg. for the glory-hole sides gives the best results. For safety reasons an endeavor is made to keep holes slightly filled above the collar of the raise. This in a measure increases the cost of secondary blasting, as there is considerable breaking effect obtained in the falling of the ore after blasting, varying with the distance of fall.

Holes are drilled on the day shift of eight hours. One or two crews, depending upon the production desired, are worked in a glory hole. Each crew consists of a drill runner, his helper, and two barmen, one acting also as a "nipper." All work in the glory holes, except for the blasting and pipe work, is contracted. The contractor, who is the drill runner, furnishes his own crew, and is paid at a rate per foot drilled, this price covering the work of "barring down" and "nipping." The average footage drilled per shift is 155 ft.

It was considered impracticable to base the contract price on the unit of tons of ore broken, for the reason mainly that part of the rock broken in one glory hole often falls into one or two adjacent glory holes.

The contract price in effect was determined after operating on the day's-pay system for nearly a year. During that time the drill runners, who were entirely unfamiliar with machine drills at the start of operations, were given special supervision before contracting the work. The need for this precaution is obvious, as it was desirable to fix a price for once and all that would prove equitable to both the company and the men, otherwise confidence in the contract system would be destroyed by subsequent changes.

The weakness of the present contract system lies in the fact that the contractor in most cases pays little, if any, more to his crew than formerly and pockets the profits himself. It is preferable to distribute the earnings among all the workmen, not equally, but in proportions based upon the relative wage values assigned to the different classes of work. On the other hand, under the present system the contractor is able to reward his men according to individual service rendered, whereas any profit-sharing plan devised by the company would have to be based upon a fixed percentage for each occupation, irrespective of the relative work done. Theoretically the existing system is the better, but it is believed that a satisfactory profit-sharing system would make for more general contentment among the men. Careful study is being given to devise a plan that will prove to be practicable and fair to all concerned.

Primary Blasting Practice Developed

The blasting crew comes on at noon, and by 5 p.m. an average number of 400 holes are loaded and ready to blast. Some blasting, principally block holing of large boulders, is done at noon. The crew consists of a head powder man and six helpers. The men work on company account, but eventually this will be contracted on a per-ton basis to include explosives.

Single-tape safety time fuse and No. 8-X caps are used for detonation of explosives, except in those holes around the rims of the glory holes and first benches where electric blasting caps with 12-ft. wires are fired

by a portable 50-cap electric battery. Electric firing requires more time for loading. The cost it entails for caps and wiring is greater, and it is impracticable in the middle or bottom of glory holes, on account of the amount of wiring required and the chance of breaking the circuit by falling rock. On the other hand, saving in powder consumption is effected when holes are blasted simultaneously with a battery; and benches are maintained in better condition. For these reasons the electric battery is used when blasting at or near the surface. Though the ground drills easily, a dynamite equal in strength and velocity to 35 per cent nitroglycerin is needed to give the shattering effect required. A bulky powder, such as Du Pont Durox or Hercules No. 1 Special, has proved the most economical explosive. A summary of results obtained with different grades of Du Pont explosives under actual operating conditions is given as follows:

Table II—Summary of Blasting Experiments With Different Explosives

	Durox	Dumorite	40% Nitro-Glycerin	Monobel	Quarry Special	40% Ammonia
Tons ore broken during test	80,048	85,312	20,988	17,312	16,516	4,100
Tons ore per pound of dynamite	6.3	6.1	5.1	4.7	4.6	4.00

Durox is rated according to strength as 35 per cent nitroglycerin, and its velocity or rate of detonation is about the same. Durox is cheaper than straight dynamite, as, being less dense, the rise in the hole for equal weights is greater, thereby distributing the explosive action over a greater length of the hole. Also, the blasters are inclined to use less by weight of the bulky powder. The lower-grade quarry explosives, such as Quarry Special, failed to break the ground sufficiently. Black powder was tried, but, owing to its slow velocity, with consequent heaving instead of shattering action, was found unsuitable for glory-hole mining.

An average of 1½ lb. of explosive, in cartridges 1⅛ in. by 8 in., is loaded in a 9-ft. hole and tamped with clay stemming, transported, for convenience and to preserve the moisture, in paper cartridges made from the paraffined packing paper of the dynamite cases. The weight of ore broken per cap is 9.3 tons, and 1.2 ft. of fuse is used per ton of ore.

Secondary Blasting by Block Holing

All secondary blasting is done by block holing. A hole 6 to 12 in. deep is drilled by machine in any rock that is too large to pass through the grizzly openings. It is loaded with one-third to one-half of a 1⅛ by 8-in. stick of Durox dynamite, and detonated by a No. 6-X cap. Bulldozing is employed only in unblocking raises.

By virtue of breaking the ore in the glory holes to a comparatively small size, explosive consumption in secondary blasting is light.

Table III—Explosives Used for Secondary Blasting

Class	Unit	Tons Ore Broken per Unit Used	Cost per Ton
1⅛ in.x8in. Durox dynamite	pounds	132	$0.0015
No. 6-X blasting caps	each	10.1	.0006
Single-tape fuse	feet	5.3	.0006
Total			.0027

Light Hollow-Hexagon Drill Steel Used

Hollow hexagonal ⅞-in. steel is used entirely. The breakage thereof is undoubtedly higher than it would be for 1-in. steel of the same section, but the ⅞-in. size has the advantage of being lighter, and, therefore, easier to distribute. No tests have been made to determine drilling speeds of the two sizes, but it is thought that the smaller steel would drill faster.

Table IV shows the steel consumption from Aug. 22, 1921, to April 15, 1922:

Table IV—Drill Steel Consumption

Tons ore broken during the period	455,020
Pounds drill steel consumed	9,390
Pounds drill steel consumed per ton ore	0.021
Cost of drill steel per ton of ore broken	$0.0028
Feet of hole drilled	344,900
Pounds drill steel consumed per foot of hole drilled	0.027
Cost of drill steel per foot drilled	$0.00364

Steel consumption is due mainly to stuck drills and breakage. Fractures filled with soft vein material are mainly responsible for the former. An effort is made to recover stuck drills by supplying a crew with special wrenches which fit around the steel directly underneath the collar and are struck upward by a hammer. An average of 3,200 ft. is drilled for every steel that cannot be withdrawn. This does not represent a total loss, as the steels are recovered in the chute. They are straightened and re-used when possible to do so, or are made into starters or sampling moils. Occasionally a drill steel or bar, through carelessness of the operators, will be dropped into the glory holes.

Records show that 330 ft. of hole is drilled per broken steel, and that 64 per cent of the breaks is in the bits, 26 per cent in the shanks, and 10 per cent in the center.

Owing to the ease with which the ground is drilled, and to the fact that part of the steel loss would be the same regardless of the grade of steel used, the determining factor in selecting a brand is price more than quality. For this reason cheap Swedish steel has proved more economical than other brands tested.

Double-Taper Cross Bit Used

The double-taper cross bit, 14 deg. and 5 deg., is standard. Although the ground is suited to ⅛-in. changes in gage, a ¼-in. variation was adopted, as less skill in sharpening is necessary. Although the drill sharpeners can be trained to make well-formed bits, it is difficult to hold them to any fine degree of accuracy.

A 24-in. change in length is used, making five pieces of steel to a set. The gage of the starter is 2⅛ in., and of the finisher 1⅝ in.

Drilling in the glory holes is performed by Ingersoll-Rand D.C.R.-13 drills of the jackhammer type. The weight of this model is 55 lb. Time studies show that the machines are actually drilling 60 per cent of the shift. The average duty per machine-drill shift is 150 tons.

For block holing, Ingersoll-Rand BAR-33 jackhammers were selected on account of their light weight. This model weighs only 21 lb., and is, therefore, conveniently carried in the glory holes and underground, from one block-holing chamber to another.

Repair costs per machine-drill shift are shown in Table V.

Table V—Repair Costs per Machine-drill Shift

Model	No. in Service and in Repair Shop	Overhead	Labor	Supplies	Power	Total
DCR-13	30	$0.002	$0.039	$0.120	$0.001	$0.162
BAR-33	6	0.0005	0.009	0.003	0.0005	0.013

The track, 36 in. gage, is laid with 50-lb. rails, on 6 x 8-in. x 6-ft. ties, spaced 24 in., rock ballasted, with a grade of 0.4 per cent in favor of the load. The roadbed was built with the utmost care, and is maintained in good condition, so that delays in transporta-

tion on account of derailments are rare. Switches are of the split or movable-point type, and are standard for a No. 3½ frog, 36 in. gage. The points are operated by a standard railroad switch stand of the upright type.

The haulage system is electrified. No. 0000, hard-drawn, grooved copper wire carries 250-volt direct current 8 ft. above the rail. The trolley-wire suspensions are 30 ft. apart and supported by 6-in. expansion bolts or by span wires, depending on the height of the roof above the track. At the loading chutes, ordinary screw-caps are used. The rails are bonded with compressed-terminal bonds concealed by the splice bars. To protect the locomotive armatures against high voltage disturbance, each locomotive is equipped with an oxide lightning arrester. The motor generator is protected by a lightning arrester connected to the feeder cable.

A train of nine cars is hauled by an eight-ton trolley-type Baldwin-Westinghouse locomotive of bar-steel frame construction. The latter is equipped with steel tires and has a rated drawbar pull of 2,000 lb. at a speed of six miles per hour. The maximum, gross trailing load is 165 tons. Two of these locomotives have hauled 1,600,000 tons to date, and have traveled a total distance of 13,600 miles with only a nominal amount of repairs. The original steel tires will be removed shortly to be re-turned for the first time.

The car for tramming ore has a rigid flat-bottom body, the capacity of which is 275 cu.ft. The truck has four wheels; the wheel base is 6 ft. 6 in. The cars are equipped with ¾ M.C.B. swivel couplings, and are unloaded in a one-car, rotary car dumper without uncoupling from the train. The drawbars work against 1-in. springs; these act in tension or compression to decrease the tractive effort when the train is started or to absorb the jolts when stopped. Single, 4x7-in. Hyatt roller bearings are inclosed in cast-steel, dust-proof journal boxes. Each journal box is supported on two ⅞-in. springs within a malleable iron pedestal. The bearings are filled with Slo-Flo lubricant once every two months. The cost of lubrication per ton of ore hauled is a negligible quantity. The wheels, 20 in. diameter are made of chilled cast iron and pressed on 4½-in. open-hearth steel axles. The average life of a wheel is eleven months, during which time 9,500 tons of ore is hauled per wheel. The body plates opposite the chute doors are lined with 20-lb. rails placed vertically 6 in. apart. The bottom plates are overlaid with 1¾-in. oak boards, which are in turn protected by ¼-in. steel wearing plates.

The cars are satisfactory in every respect. They are subjected to extremely hard usage, owing to the size of the material handled and the large tonnage (about 200 tons) trammed per car per day.

The rotary car dumper originally installed was too light for the service. A dumper of similar design, but of much heavier construction, was fabricated locally and is giving entire satisfaction. It is operated by compressed air. The air cylinders are connected to the compressed-air main, and also to an independent 100-cu.ft. compressor, which can be used to operate the car dumper in case of an air shortage.

Two trains of nine cars each handle the production. A motorman and two brakemen comprise a train crew. The brakemen and one chute tender, who assists both crews, load the cars. Two men operate the underswing arc gate, and the third works the check gate. A policeman's whistle is used to signal the motorman. In addition to the train crews, the following men are employed on each shift: one car-dumper operator, one switchman, three men to repair chutes and to timber, one man to clean tracks, and a shift boss, who supervises the block holing on the grizzlies as well as the loading of the trains.

The empty incoming train and the outgoing loaded train pass each other on a double-tracked portion near the crushing plant. The unloading time is governed by the crushing rate, as the storage capacity of the coarse-ore hopper above the 30-in. gyratory crusher is practically nil.

An average time analysis of the different tramming operations involved shows the following:

	Minutes
Loading	11
Transporting to switch	6
Waiting at switch	3
Switch to crushing plant, dumping and return to switch	25
Returning empties to loading chutes	5
Total for round trip	50

Average tramming distance, 2,300 ft.

No ore tramming is done from 7 to 11 a.m., this period being used to inspect the crushing plant thoroughly and to make the repairs necessary. Advantage is taken of this period to haul waste to the dump. Experience has proved that the crushing plant can be kept in better condition and that less time is lost when inspections and repairs are made regularly each morning.

Detailed tramming costs are shown in Table VI.

Table VI—Tramming Costs Per Dry Ton Hauled

	Maintenance						Total Cost			
Operation	Cars	Tracking	Locomotives and Motor Gen.	Car Dumper	Trolley Lines	Loading Chutes	Labor and Bosses	Supplies	Power	Total
$0.0174	$0.0071	$0.0020	$0.0012	$0.0013	$0.0017	$0.0033	$0.0218	$0.0073	$0.0049	$0.0340

When it becomes necessary to mine unprofitable material in any glory hole, the broken ore is drawn out before the waste is blasted. Hand-operated side-dump cars of the contractor's type are used to haul the waste from the loading chutes to the waste dump. The capacity of each car is 4 cu.yd.; the over-all height is the same as that of the ore cars.

Only a small part of the mine superintendent's time is required to supervise the glory-hole operations, the remainder being devoted to the more complex underground work. The supervision is performed mainly by a foreman, who directs the daily routine work of drilling and blasting. Shift bosses, under his direction, supervise the loading and tramming. The total charge for supervision is small.

Chute Sampling Eliminated

On account of the low silver content, and the equally oxidized appearance of the ore and unprofitable material, it requires experience and close observation to distinguish between them. At the outset of operations, a large crew of samplers was employed taking cuts along each bench. The work was minimized afterward by sampling only doubtful faces, and finally this has been left to the foreman, who now takes a few samples himself whenever in doubt.

Owing to the fact that there is no hold-up by storage

ahead nor within the crushing plant, it is possible to take automatic samples of car- or train-load lots in the sampling plant after crushing. A large bulletin board, placed at the car dumper, is visible from the sampling plant. When a train load reaches the crushing plant, large placards are posted to show the numbers of the glory holes from which the ore was drawn and the number of cars. A bell is sounded in the sampling plant to notify the sampler of the arrival of the train. Independent automatic samples are taken of each glory-hole lot, in addition to the general head sample. The average grade determined by taking the tonnages drawn from each glory hole and the respective grade thereof checks the head sample to 0.5 of 1 per cent. The tonnage figures are obtained by weightometer, which is checked weekly by weighing several train loads on the track scale. The system gives an accurate assay value of the ore drawn daily from each glory hole, eliminating the need for taking chute samples, which are unreliable.

When the grade of ore from a glory hole drops below the economical limit, the material is handled as waste. Thereafter, every fifth carload is drawn into an ore car and delivered to the crushing plant. An automatic sample is taken of this lot to check previous sampling. An exception is made where a large tonnage of unusually low-grade material has to be removed, in which case the sampling interval is increased.

A close check on the routing of waste and ore is made possible by this system. As the grade of the unprofitable material usually is close to the commercial grade, the treatment of every fifth carload of waste represents an inconsequential loss. The expense of taking hand samples would more than offset the loss involved in treating whatever unprofitable material is milled, and the results obtained by this method would be less reliable.

Drill-Sharpening Done Efficiently

The sharpened steel is distributed to the "nippers" from a small shed close to the glory-hole operations, and the dull steel is returned to it. Both the sharp and dull steel are hauled on muleback to and from the drill-sharpening shop, which is near the portal of the adit, the hauling being contracted. This shop also serves the deep mine.

The layout of the shop makes for convenience and for a minimum of wasted effort. From the time the drill steel is deposited in a large sorting table until it is stacked in the finishing racks it is routed without any unnecessary handling. The shop arrangement and the sharpening and tempering methods follow closely the practice in the best shops of the large mines in the Southwest. A detailed description therefore is unnecessary in this article.

Sharpening is done by two Waugh Model No. 8 Sharpeners. Drills are heated for sharpening and for tempering in separate furnaces, each built locally according to an original design of Tom Davies, of the Ingersoll-Rand Co. The furnaces run quietly and uniformly, emit little smoke, and have given better results with crude oil than any other type tried. A small blower supplies air at 3 lb. pressure to all the forges and furnace within the shop.

All sharpening is done on the day shift. The shop personnel consists of one Mexican shop foreman, two sharpeners and two helpers, and one temperer and helper.

Table VII—Steel Sharpening Data

	Labor	Supplies	Power	Total
Cost per piece sharpened	$0.0162	$0.0136	$0.0128	$0.0426
Cost per ton ore broken	.....	.....	.....	0.0057
Pieces sharpened per sharpener-shift	.....	.....	.....	300
Crude-oil consumption, gallons per burner hour				2.4

Tests Made to Determine Air Consumed

An exhaustive series of tests made to determine the actual consumption of air shows the following:

	Cu.Ft. of Free Air Per Min. at 80 Lb. Pressure Unit	Total
Average consumption 1 DCR-13 drill when working	96	
Average consumption 1 DCR-13 drill during 8-hr. shift	61 (a)	
Average consumption 30 DCR-13 drill during 8-hr. shift		1,830
Average consumption 6 BAR-33 drill during 8-hr. shift		30
Average consumption rotary car dumper during 8-hr shift		40
Average consumption 1 Waugh Model No. 8 drill sharpener during 8-hr. shift		55
Total		1,955

(a) Includes air used in blowing out holes.

The above covers any leakage at the machines but not in the air lines.

It has been proved that an air pressure of 80 lb. at the drills is the most economical pressure to carry, as the ground drills easily. By increasing the speed of drilling, higher air pressures decreased the cost of drilling, but not enough to compensate for the heavier charges for power, machine-drill repairs, and steel breakage resulting therefrom. The sizes of the main and branch air lines are carefully figured so that the drop in pressure between any drill and the compressor will not exceed five pounds.

Labor Statistics

The distribution of labor and the tons broken for each group averages as follows:

Classification	Number of Shifts per Day	Per Cent Total	Tons Per Man-Shift
Development (variable)	45	16.1	79.3
Drilling—contract	103	36.5	34.7
Drilling—day's pay	18	6.4	197.2
Primary blasting	7	2.5	510.0
Secondary blasting	48	17.1	74.3
Timbering	...	...	...
Loading and tramming	42	15.0	85.0
Air piping	3	1.1	1190.0
Steel sharpening	4	1.4	893.0
Tracking	4	1.4	893.0
Miscellaneous surface labor	7	2.5	510.0
Totals and averages	280	100.0	12.8
Totals and averages for men charged to ore breaking	179	63.6	20.0

Mining Costs Summarized

Average mining costs per month are given in the following:

		Per Ton Ore
Development (based upon 6,000,000 tons developed)		
Drilling		$0.017
Timbering		0.009
Tracking, not including rails		0.003
Loading and tramming		0.004
Explosives		0.004
Lighting		.....
Total		$0.037
Ore breaking		
Stripping	$0.005	
Drilling	0.072	
Secondary blasting	0.018	
Timbering	.....	
Explosives	0.046	
Lighting	0.002	
		$0.143
Loading and tramming		0.034
Surface expense (a)		0.003
Engineering and drafting		0.002
Sampling and assaying		0.003
Supervision		0.004
Total operating expense		$0.226

(a) Miscellaneous only. Drill-sharpening, compressed air, air-piping and machine-drill repairs are distributed accounts, which are apportioned against the direct accounts in each case according to the relative benefits received.

The costs given in the foregoing table are segregated as follows:

	Labor and Bosses	Supplies	Power	Total
Development	$0.022	$0.015	$0.002	$0.037
Ore breaking	0.059	0.057	0.027	0.143
Loading and tramming	0.020	0.007	0.005	0.034
Other accounts	0.009	0.003	.....	0.012
Totals	$0.110	$0.082	$0.034	$0.226
Percentages	48.7	36.3	15.0	100.0

Of interest in connection with glory-hole mining is the low cost of producing 3,500 tons per day.

	Labor	Supplies	Machinery	Eng. and Supt.	Total
Drill-sharpening shop	$1,272.28	$1,659.94	$3,709.62	$44.01	$6,685.85
Mine compressor (including motor)	612.01	564.62	12,846.56	136.05	14,159.24
Compressor building	993.23	1,312.20	213.06	155.48	2,673.97
Electrical installation	187.33	126.85	1,895.58	33.65	2,243.41
Rotary car-dumper	805.37	329.30	98,86.45	290.30	11,311.42
Permanent track (material only)	.....	1,459.44	13,912.05	.....	15,371.49
Electrification of tracks	.....	697.30	3,863.23	29.76	4,590.29
Motor-generator set	60.37	17.84	2,684.17	25.11	2,787.49
Electric locomotives	40.47	11.51	13,501.33	.....	13,553.31
Ore cars	37.03	195.07	30,980.50	.....	31,212.60
Waste cars	.....	.....	11,871.86	.....	11,871.86
Air lines	.....	.....	13,018.24	.....	13,018.24
Air drills	.....	.....	9,924.72	.....	9,924.72
Locomotive-repair shed	140.08	101.83	.....	31.20	273.11
Totals	$4,148.17	$6,475.90	$128,307.37	$745.56	$139,677.00

Most of the equipment was purchased during the peak of high prices prevailing after the termination of the Great War. All renewals are absorbed by operation and covered by the costs given in the foregoing summary of mining costs.

The system of drilling short vertical holes closely spaced is unquestionably the best one for breaking the ore in glory holes where labor is inefficient. The tonnage broken per foot of hole drilled is low, but the final result is better than when deep holes are drilled at greater intervals.

The duty per machine shift could be increased considerably by drilling deep holes with a machine mounted on a tripod; also, less barring and shoveling would be required to secure a clean face for drilling, but more secondary blasting would be needed, and undoubtedly the raises would be choked more often. At Fresnillo, a mounted machine is out of the question, as too much time is lost in starting and drilling a hole. The jackhammer type of drill requires less skill to operate than the mounted machine, and, therefore, is more suited to the local labor.

The ground stands well without support, making it well suited to the glory-hole system, for the reason that the raises need not be timbered, and hence require no subsequent attention.

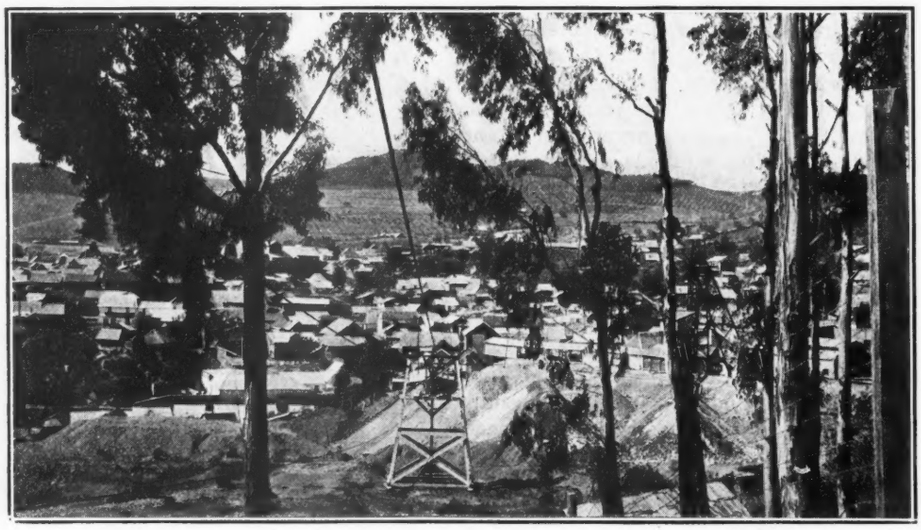
A glory hole having a diameter of 150 ft. has a comfortable capacity of 15,000 tons per month. The production is limited by the rate the ore can be drawn through the grizzlies. The development work was completed at the outset to provide enough glory holes to assure production at all times, even though a number of glory holes were non-productive at one time on account of mining waste, choked raises, or broken grizzlies. As a consequence there has been nothing to interfere with the loading and tramming, this making for few delays and less confusion.

Glory-hole methods are most successful where there is little rainfall and no snow. The climate at Fresnillo is ideal. The rainy season extends from July into September, but there are only a few heavy rains. When these last for several days the capacity of the crushing plant has been reduced by as much as three-quarters, owing mainly to the fact that the vertical Symons disk crushers will not handle wet ore. During wet weather, the glory-hole raises are kept empty, otherwise the broken ore packs and blocks them; also, the fine material becomes like mud. Slippery working faces make glory-hole work dangerous. When this condition exists, drilling is done only on the rims of the holes.

Few accidents have occurred, only one of these being fatal. The rate is much lower than for underground mining. Steep slopes and lack of proper attention in barring down loose ground make for more accidents. The men are required to use ropes, but infractions of this rule are hard to stop.

Apart from natural conditions, the loading arrangements are largely responsible for the success attained in glory-hole mining. Even these, however, would not prove satisfactory unless the ore were broken to suitable size by the primary blasting.

I am indebted to C. E. Prior, mine superintendent, for his assistance in preparing this paper, and to Max Dixon, geologist for the company, for the geological data.



Aerial tramway from San Ignacio mine to Guerrero mill, Mexico

Roasting Ores in Hydrogen

Australian Experiments Indicate Possibility of Treatment of Copper and Iron Sulphides to Recover the Iron and Sulphur as Well as the Copper

By Hartwell Conder

Mining Engineer, Strahan, Tasmania

ON THE WEST COAST of Tasmania is a belt of country about 50 miles long by 25 wide which has proved remarkably rich in many forms of mineral. Of these minerals not only the copper-bearing but those containing tin as well are closely associated with dense bodies of iron sulphide, pyrrhotite as well as pyrite. These sulphides have been useful in the past to provide fuel and flux for pyritic copper smelting. This process, however, was costly and wasteful and has now been superseded by flotation methods. With the tin, the presence of the iron sulphides has been the adverse factor.

A good many years ago, in reporting for the Tasmania Government on one of the tin fields, I said that the only hope was to apply the cheap power, which can be secured here, to these ores and endeavor, with this weapon, to wrest a profit from those constituents which at present compel a loss. Considerable work has been done by the Mount Lyell company in attempts to save some of the sulphur wasted in pyritic smelting. For the most part this work had been based on the dissociation of one atom of the sulphur in pyrite by heat and condensing the sulphur fume evolved. This was no new idea; it had been done years ago in crude fashion even in heap roasting, but trouble in bringing away the fume, and in condensing it in the right place, had prevented this method from becoming a success in those days of cheap sulphur.

Power on the west coast of Tasmania can be secured for one-tenth of a penny per kw.-hr., or £3 13s. per annum. If water be electrolyzed, 6 cu.ft. of hydrogen can be obtained from one unit, that is from 1 kw. every hour. Sulphur and hydrogen will burn together to form sulphuretted hydrogen gas. It occurred to me that if pyrite were heated in the presence of hydrogen the loose atom of sulphur would be dissociated by the heat and unite with the hydrogen. It was found on experimenting that this result took place, and that if a current of hydrogen be passed over pyrite heated to a dull red heat, practically all the "loose" sulphur is removed from the ore as sulphuretted hydrogen, and ordinary ferrous sulphide remains.

In the alkali works in England much sulphur was lost in the old days in the black ash process. A process known as the Claus Chance was evolved to convert this sulphur into sulphuretted hydrogen and recover it by passing the gas with a limited quantity of air over heated ferric oxide. This process is well established and is very cheap; I had relied on it to recover the sulphur from the sulphuretted hydrogen produced from pyrite. It was, however, soon perceived that there were difficulties. Although all the available sulphur can be removed by the hydrogen, it does not seem possible in practice to consume all the hydrogen; if free hydrogen were sent along with the sulphuretted hydrogen to the Claus Chance furnace, the result would be obvious but startling. Hence, although the portion of the process which had been in doubt—that is the percentage extraction of the sulphur—had turned out all right, the other portion, where a recognized means of recovery seemed available, proved quite abortive.

All sorts of methods to get the sulphur back were studied and investigated; combining sulphuretted hydrogen and sulphur dioxide, heating the sulphuretted hydrogen, dissociating with chlorine or iodine and recovering the halogens by electrolysis, passing electric sparks through the gas, and finally passing the gas into a solution of ferric chloride. Only the two last proved in any way satisfactory. High-tension sparks deposited the sulphur; at first the power consumption was excessive, but this factor was gradually improved upon, and as this dissociation restores the hydrogen to the circuit, the method deserves further practice.

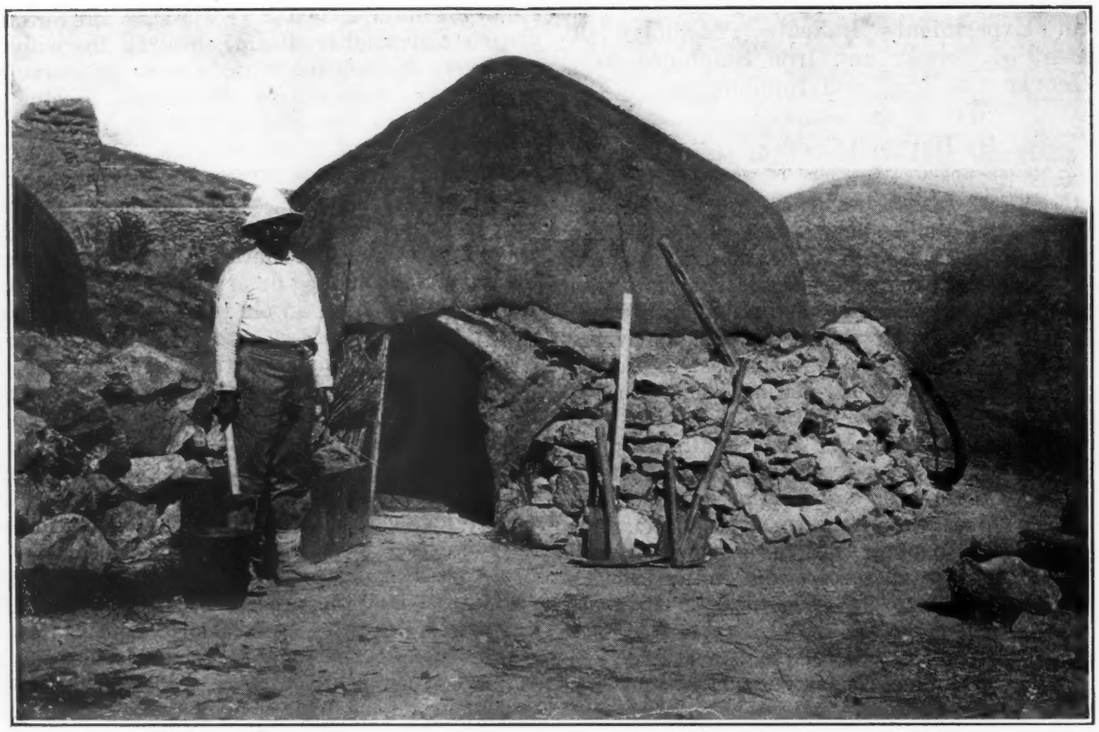
Finally, acting on an old record of alkali works practice, the gas was passed into a solution of ferric chloride. Now, the union of the third atom of chlorine with the iron atom, and of the hydrogen atoms with sulphur, is weak compared with the bond between hydrogen and chlorine, so that ferric chloride turns into ferrous chloride, sulphur is deposited and hydrochloric acid is produced. The sulphur, with proper strength of solution, settles out readily; if the solution containing the ferrous chloride and hydrochloric acid is electrolyzed, hydrogen is evolved and ferric chloride reconstituted and the process becomes cyclic. The dissociation voltage of hydrochloric acid is lower than either that of water or of ferrous chloride, and there is no need to carry the reaction to completion, so that the cost of producing hydrogen by the regeneration of the solutions should, if anything, be less than when it is derived from water.

The cost of the hydrogen per ton of sulphur produced is about £1 14s. 8d. Flotation concentrates or pyritic tin concentrates are already in good condition for treatment. The margin, even with ores treated for sulphur alone, appears to be sufficient for Australian conditions.

One special development is most interesting. As a result of the treatment above outlined, the pyrite, or FeS_2, is converted into ferrous sulphide, or FeS. Now, the extra sulphur atom in the pyrite makes it impervious to hydrochloric acid, but this acid acts on ferrous sulphide with the production of sulphuretted hydrogen and ferrous chloride. If, therefore, the ferrous sulphide product from the hydrogen roast is treated with hydrochloric acid, ferrous chloride is produced in solution and sulphuretted hydrogen gas given off. Electrolyze the solution and the ferrous chloride deposits iron and becomes ferric chloride. Pass the hydrogen sulphide into this ferric chloride and the sulphur is deposited as before and a solution containing hydrochloric acid and ferrous chloride is produced ready again to deal with more ferrous sulphide. This cyclic process calls to mind the Eustis process, but differs vitally from it in that Mr. Eustis claims ferric chloride as the dissolving agent, whereas I desire the presence of no ferric chloride in the dissolving solution.

Estimates have been made carefully and the verdict at present is that electrolytic iron would have to be sold for about £10 per ton to give sufficient profit to warrant the very large outlay involved.

The whole research was most interesting, and in these days of cheap hydrogen the scope of the hydrogen roast deserves thorough investigation. Danger and trouble were anticipated from explosions, as 5 per cent of either hydrogen or oxygen in the other is explosive; only once, through the spirit of independent investigation infecting a boy assistant, did trouble occur from this source, and that was not repeated.



A Yurta, the native dwelling where the members of the commission lodged during their stay at the mine

Tuya-Muyun Radium Expedition in 1922

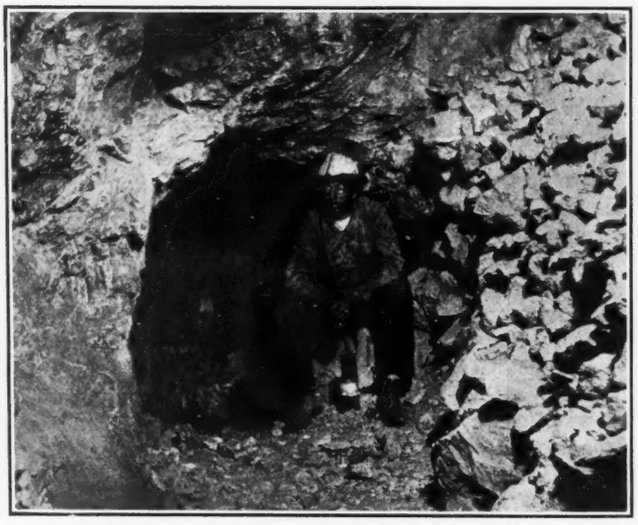
Deposits in Fergana, Turkestan, Are of Economic as Well as Geologic Importance

By S. P. Alexandroff
Mining Engineer, Petrograd, Russia

THE Tuya-Muyun radium deposits in Fergana[1] were examined during the summer of 1922 by a special expedition organized by the State Radium Institute of the Russian Academy of Sciences and the Central Administration of Prospecting and Exploration of the General Administration of Mines. These deposits are situated in the southeastern part of Fergana in the lower zone of Alai Mountains, about 60 km. easterly from Skobelev, a station of the Transcaspian railway, and 30 km. southwesterly from Osh, a small town in Fergana.[2] The deposit is of a special interest, as the minerals are deposited by circulating waters on the walls of caves and along fissures and cracks, which were formed in the Paleozoic chalks, probably due to tectonic action.

Chemically and mineralogically the ore is complicated. Minerals forming the ore are: tyuyamunite, $CaO.2UO_3.V_2O_5.4H_2O$, uranovanadate of calcium; folbortite, vanadate of calcium and copper; turanite, $5CuO.V_2O_5.2H_2O$; vanadate of copper; radioactive barite; and other minerals. Calcite forms the gangue matter.

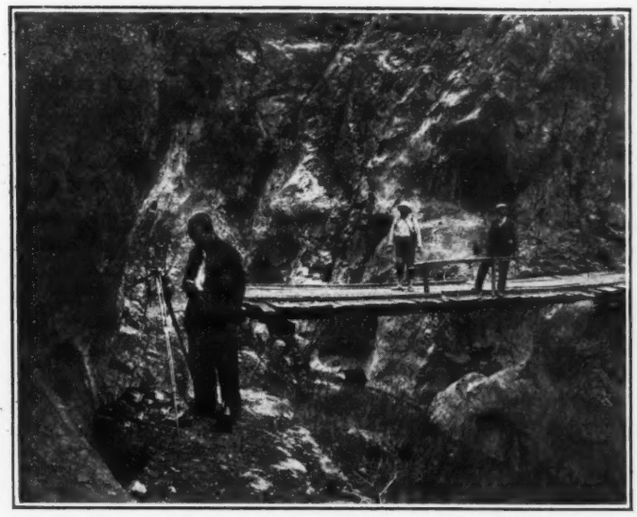
The deposit was well known to the Chinese, who worked it for copper. Their mining methods were, of course, primitive. Only in 1904 was more or less systematic mining started, with a view to getting accurate information concerning the nature and size of the de-



One of the crosscuts of upper level of the mine. Over the head of the man can be seen a strong lode of tyuyamunite

[1]A province of Turkestan; mid-Asiatic dominion of Russian Republic.

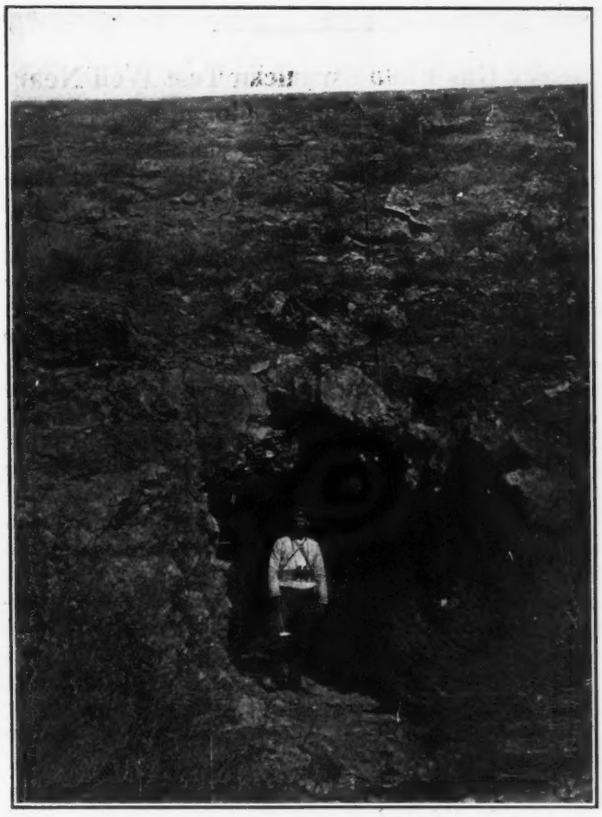
[2]Geographical co-ordinates of Tuya-Muyun 40 deg. 21 min. N. Lat. and 72 deg. 35 min. E. Long.



Testing the water for radioactivity in one of the springs of the passage Tanga, on the Aravan-Say River

posit. The work was carried out by a Russian mining company, the Fergana Rare Metals Mining Co., but its records were not published and much information as regards Tuya-Muyun is therefore not available.

During all this time, until the operations were stopped in 1914, the total output was about 1,000 tons, of which 700 tons was treated to extract copper, uranium, and vanadium. The remaining ore and the residue after chemical treatment, containing 2.3 gm. of radium, formed the basis of raw ore reserve for the radium works, erected by the State Radium Institute, on Kama, in the district of Yelabouga, Government of Kazan.



The entrance of the adit of Tuya-Muyun radium mine

In view of possible resumption of mining operations at the abandoned mines, in order to get a normal supply of raw ore for the radium works, and with the object of exploring and collecting data regarding the district to be prospected, the special commission was sent and was under the general leadership of S. P. Alexandroff, mining engineer. Other members of the commission were: A. A. Aniskovich, geologist; A. P. Kirikov, geologist; B. K. Brounovsky, radiologist; W. A. Basmanoff, mine foreman; G. P. Alexandroff, of the Ordnance Survey of Russian Army, and two representatives of the radium works. Notwithstanding various obstacles which the

The return of some of the members of the commission on the wagon road along the Aravan-Say River. The landscape is typical for the lower zone of the Alai Mountains

expedition had to overcome, the program as planned was carried through.

Underground workings of the mine have two levels. The upper level is a complicated system of interconnected natural caves. The connecting drives were made by former explorers. The upper level is about 14 m. from the collar of the shaft. The lower level contains a series of small caves, connected by crosscuts, made by the use of explosives. The caves of the lower level start at the depth of 26 m., go deeper and deeper, forming a rough spiral, and end at the depth of 59 m. from the collar of the shaft. The total length of the workings of the lower level is about 48 m. A shaft, sunk from the top of Tuya-Muyun hillock, passes through a large cave rather elongated in the vertical direction. It ends at a depth of 35 m. in country rock. Practically all the old workings are of prospecting character. The ore which was used for manufacturing purposes is the output of these underground prospecting operations. There are

no signs of systematic development and exploration of the mine.

The ore reserves which are ready for working are estimated by the commission at 5,000 tons, of which 1,600 is in the upper level. In the large cave intersected by the shaft the reserves are 800 tons and in the lower level 2,600 tons.

Considering that 250 to 350 tons of raw ore contain 1 gm. of radium, the visible reserves must contain:

Radium, grams	15 to 20	Vanadium, tons	90
Uranium, tons	60	Copper, tons	120

To get correct data of assay values numerous samples were carefully taken by the commission.

Besides the examination of the existing workings, some exploratory work has been done, and as a result of this a new lode, called the "Academic," was discovered 180 m. west of the main lode. The conditions were considered satisfactory for the starting of mining operations. Thirty tons of the best ore was sent to the radium works. To transport this to the nearest railway station, Fedchenko, on the Transcaspian railroad, about 60 km. of wagon road had to be repaired.

The commission did a good deal of geological work at the mine and in the district, collected a lot of valuable mineralogical specimens, carefully tested for radioactivity, made underground and surface surveys, and prepared plans for further prospecting and operating. After four months' absence the commission returned via Tashkent, the capital of Turkestan, to Moscow.

On the basis of data collected by the commission, it is proposed to resume operations at Tuya-Muyun, at some time during 1923, with an output of about 500 tons per year of picked ore, to begin with, and to increase the output gradually, when the ore reserves are more fully developed.

Photograph of a Gold-Quartz Veindike

By J. E. Spurr

IN MY ARTICLE on "The Pre-Cambrian Veins of Kirkland Lake, Ontario," in the issue of the *Journal-Press* of Oct. 20, 1923, I described (p. 671) an intrusive veindike of gold-bearing quartz, which is exposed on the surface at the Tough-Oakes mine. Subsequently, Mr. K. B. Heisey, engineer at the Tough-Oakes, has kindly photographed the vein and sent me the negative, so that I am able to publish the accompanying photograph.

A gold-quartz veindike, Tough-Oakes mine, Kirkland Lake, Ontario

As I stated in the article above referred to, this vein carries $10 to $12 gold. The filling is of homogeneous massive white quartz, which incloses many angular isolated fragments of the country rock (porphyry). This is an excellent example of an intrusive veindike. No mechanism of its formation is conceivable to me except that the gold-quartz magma was suddenly injected, along a pre-existing tight fissure, in not far from the same state of concentration as at present; and that after injection it crystallized (froze) much after the manner of rock magmas which thus form dikes.

Heavy Gas Flow Struck in Test Well Near Fort Collins, Colorado

The test well which is being sunk by the Union Oil Co. of California in the Fort Collins district, Colorado, about 75 miles north of Denver, struck a flow of gas on Nov. 11 at 4,285 ft., which was estimated at 100,000 cu.ft. per day. The flow rapidly increased, and is now believed to be coming from the bore at the rate of 100,000,000 cu.ft. or more every twenty-four hours. No gage of the capacity of the well has been made, nor has the drilling crew yet attempted to restrain the flow, because of the extremely heavy pressure at the mouth of the well. Tools and appliances for taking care of the well have been hurried from the Casper field, and the management hoped to have the well under control within a few days.

The well is six miles northwest of Wellington, a town on the Colorado & Southern Railroad on a dome of the same name, which is a part of an anticlinal fold covering an area about 14x2 miles in dimensions. The Wellington dome is about 5 miles long and 1 mile wide, and includes about 4,000 acres—possibly more. All the land on the structure is leased by the Union Oil Co., as is all the land on a structure about 5 miles south which is known as the Fort Collins dome, and which is smaller in area.

Geologists who have been in touch with the development believe the gas is coming from the first Wall Creek sand.

How the Diamond Drill Proved Useful on One Oil Lease

It Showed Absence of Structure, Explaining Failure to Find Petroleum Indicated by Study of Surface Geology and Other Test Work

By Joseph Purzer
Petroleum Geologist, Tulsa, Okla.

DIAMOND CORE DRILLING, though long used in the mining industry, was never tried in the oil fields, at least not in the Mid-Continent district, until a few years ago. The areas were worked in the usual way on surface geology whenever possible. Territories with no surface outcroppings were either passed over or tested out by drilling a deep test, not always with gratifying results. Small churn drills also were employed to determine structure favorable or otherwise to the accumulation of oil and gas.

It was in this manner that the U. S. Geological Survey examined the surface geology of the Chilocco Indian Reserve, in Kay County, Okla., in 1919. The examination was not entirely satisfactory, owing to the lack of outcrops upon which to make determinations of structure. Such outcrops as were found seemed to indicate the presence of two anticlinal folds, one in the southern and one in the northeastern part of the Reserve, but the evidence was not sufficiently conclusive to justify definite statements concerning their positions.

Accordingly, it was recommended that the U. S. Indian Department drill six shallow wells with a churn drill on locations designated by the Geological Survey, and that a complete record of the strata traversed be kept by taking samples every 5 ft. This was done. The sets of samples, although not complete, were sufficient to furnish the needed information, and as a result the conclusion previously made was modified.

These wells were drilled to the Herrington limestone, a very pronounced key-bed in that territory, and drilling was discontinued when the limestone had been penetrated to a depth of 3 ft. The location of five of these six wells, their total depth, and the depth to the Herrington limestone, or what was considered from the samples to be the Herrington, is shown on the accompanying map (Fig. 3).

Judging from the elevations at which the Herrington lime was found in wells 1, 2, 3, 4, and 5, the Chilocco anticline is composed of two distinct dome-like folds, separated by a rather pronounced syncline. The crest of the easternmost of these domes was considered to be in the south center of Sec. 23 and north center of Sec. 26, T. 29 N., R. 2 E. It was not possible from data available to outline either of these folds accurately. The outline of the westernmost was particularly

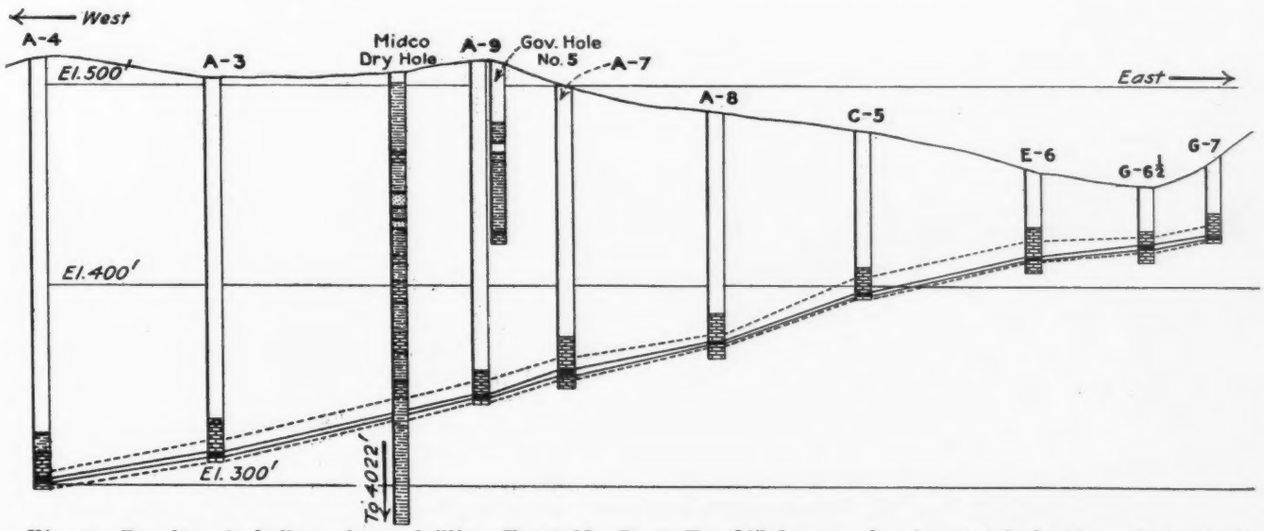


Fig. 1—Results of shallow churn drilling T. 29 N., R. 2 E., Oklahoma, showing total depth and depth to supposed Herrington limestone

indefinite. However, it was considered certain that both were distinct folds and that, if error was made in their estimation, it was on the side of conservatism.

The west Chilocco anticline, according to the results obtained from churn samples, should have had a dip to the east and north of at least 40 ft. and probably 80 ft., and it could have amounted to 100 ft. This would have made it of the same order of magnitude as the small anticline on which are located the gas wells east of the town of Newkirk in T. 29 N., 3 E. There seemed no reasonable doubt that an anticlinal fold of sufficient size and fully worth prospecting was present in the southern portion of the Chilocco Indian Reserve. However, the dimensions and economic importance of this structure remained to be demonstrated, and whether it contained oil or gas in commercial quantity. The Beaver Creek anticline in northern Kay County, Okla., proved barren.

The best location for a deep test on the Chilocco anticline seemed to be about the middle of the north half of Sec. 28, T. 29 N., R. 2 E. The Mid-Co Petroleum

Co. leased a block of 2,560 acres, the area containing most all of the territory tested out by the churn drill and considered favorable. Provision was made in the lease for three deep test holes. The Mid-Co company drilled a well according to government location in the northeast quarter of Sec. 28, T. 29 N., R. 2 E., to a depth far below the point where the operators expected production, and found nothing.

The favorable location as to structure became doubtful and a diamond core drill was put into operation to determine the structural conditions more exactly, as it had been thought that the churn drill holes were too few. The deep test at that time was going at 3,150 ft. with no indication of the oil or gas which was expected a few hundred feet above that depth. The outfit consisted of a hydraulic drill driven by a Gray motor. Core 1¼ in. in diameter was taken. A churn drill was used in the beginning to drill to solid rock on the first few holes, but this was discontinued, as it was found the holes were in better condition and the cost varied very little when drilled with a fish-tail bit by the diamond drill from the surface. The total depth of the holes ranged from 65 to 190 ft. Drilling on each hole was stopped a few feet below the base of the Herrington lime. In no case was there any doubt as to classification of the core samples, and it was shown that in correlating the samples from the churn drilling on that lease some serious mistake had been made. Holes were drilled a quarter of a mile apart in the beginning, but later on it was found practicable to drill a half mile and even farther apart. The machinery was mounted on skids and the moving under ordinary conditions and setting up took about a half day and was accomplished by simply detaching the drill from the motor and taking it to the desired location. One or two joints of 3-in. casing were used for surface casing. The ordinary average drilling done in an eight-hour day and in rock varied from 30 to 35 ft. Soft strata drilled with a fish-tail bit went, of course, much more rapidly.

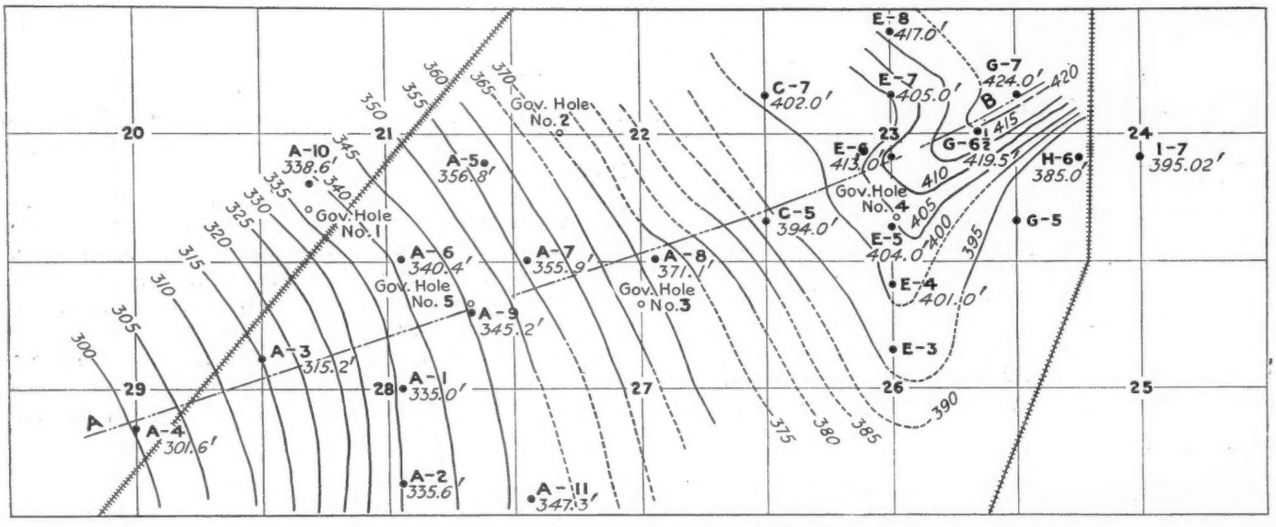


Fig. 2—Results of shallow diamond drilling T. 29 N., R. 2 E., Oklahoma; 5-ft. structure contours based on spotted horizon of Herrington limestone

The map shows the holes and their total depth and also the depth to the Herrington lime. It shows on the major part of the lease, especially on the west side, that there is no structural evidence to justify drilling a well at either of the locations recommended by the Indian Department or at any other location of the Chilocco lease held by the Mid-Co company. The contours show an approximate uniform regional southwest dip across the area around the Mid-Co deep test, which shows that there were no structural facts as assumed from the churn-drill samples and no reason for drilling a well thereon. The portion of the log of the Mid-Co deep test is shown on Sec. A-B, which found lime that corresponded to the Herrington lime in its stratigraphic position in the regional dip southwest.

The government hole No. 5 is also shown in this section, and it is evident beyond question that the hole did not reach the Herrington lime, as given in the government report. This is one of serious errors upon which the structural data of the government was based. The same data determined the location for the test hole drilled by the Mid-Co company to a depth of 4,022 ft. and which was found dry.

The whole operation of proving up this area with a diamond core drill took about two months, and a fractional amount of the money and time required by the deep test, which took thirteen months of drilling and an expenditure of approximately $120,000. The work was very successful in obtaining the desired geologic information as to that particular territory, and later on gave the same certain results in Noble County, Okla.

There are at present a number of diamond core drills in operation by the leading oil companies in the Mid-Continent district for the purpose of proving up territory. Such drilling has now passed the experimental stage.

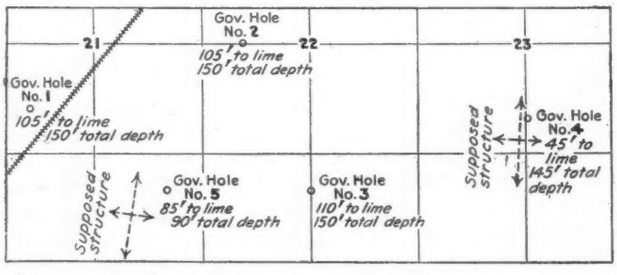


Fig. 3—Cross-section along line A-B in Fig. 2. Vertical scale exaggerated

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

"Concerning Rich Ore"

THE EDITOR:

Sir—My copy of your ever-welcome and most instructive journal for Sept. 1 contains two articles of more than usual interest to mining men: to miners *per se*—as distinct, I mean, from engineers. I allude to the article, under the heading "Concerning Rich Ore," from

A. Spencer Cragoe

the facile pen of my old friend and mentor T. A. Rickard, and to the very excellent description of the Keeley silver mine featuring its geology and lode structure. Even your valuable paper gives us too little of this kind of thing, and I would like to see at least one comprehensive if brief description of some famous mine, strongly featuring its underground characteristics and lode formation and well illustrated by sketch and photograph, in every issue of the *Journal-Press*. It is my humble opinion that one of the prime failings of our profession today is that there are far and away too many engineers and too few miners connected with it. Hence the decadence of mining. With those few notable exceptions which prove the rule, I would back any good mine captain of Cornish ancestry, or any experienced Mexican or South American foreman of Spanish or Portuguese descent, to find ore—and to stay with it when found—against the most highly trained American, Canadian, Scottish or Saxon-English engineer; the average Frenchman or German is not in it at all: excellent administrators, metallurgists, organizers, and engineers *ad hoc*, but *not* miners. The Scandinavians, perhaps, have some mining "sense."

With this much said—and I sincerely trust that I convey no offense—I would like to contribute a few instances of "rich ore" from my own remembrances of two or three mining fields. Strangely enough, after extended wandering through many lands, it is these few only which stand out at the moment.

Nearly twenty-seven years ago, at the Frontino and Bolivia mines, in Colombia, I recall the main lode of the Marmajito mine, assaying, month in, month out, about 30 oz. per ton in coarse, free gold, associated with heavy galena over about 3½ ft. width. This stuff, carrying about 25 per cent lead, was crushed under light wooden stamps (iron shod) and the coarser gold was recovered by inside amalgamation. The intermingling of this coarse yellow gold with the blue-black galena I shall ever remember. Our average extraction was only 33 per cent, so that about 20 oz. per ton, with every bit of the lead, went down the stream. When I left in 1897, a rude system of concentration was at last being installed. They were already underhand stoping below the adit, but the then famous superintendent, Capt. John Penberthey—half-brother of Sir Henry Irving, the actor—used to say to us in broad vernacular (no man who breathed could be better spoken when he chose to be), "Take 'un out by the hair o' the head, me son—he'll last my time."

In the north and northwest of Mexico, for the ten years from 1901 to 1911, I was privileged to see much rich ore and some phenomenal orebodies. Of these latter the main oreshoot of the San Francisco del Oro mine, near Parral, Chihuahua, was the biggest body of high-grade complex ore that I have ever seen. When I introduced this wonderful property to Colonel Rowland Fielding, in 1902, the oreshoot I write of—a deep adit level—was just over 800 meters, or more than half a mile, long, with an average width, I think, of 12 ft.; varying from 3½ to upward of 30 ft. The average assay throughout was over 15 per cent lead, 27 per cent zinc, 27 oz. in silver, a little copper, and a little gold. Colonel Feilding's and my judgment in taking over this property was then much criticised—because, of course, of the ore's complexity: the very large profits which are now being earned prove our views to have been well founded.

The surface carbonate ores of this mine—nearly exhausted when I first knew it—were very rich. I clearly recall seeing carload lots of up to twenty tons assaying about 40 per cent lead and over 3,000 oz. per ton in silver. The native silver stuck out from this soft, yellow, crumbling ore, literally in chunks—pieces ounces in weight. The acquirement of this property by the then owners for only $7,000 Mexican—say $3,500 gold, as exchange then was—at a forced sale three or four years previously when the carbonate ores were already supposed to have been exhausted; their rediscovery and sale of further carbonate ores at a big profit; then their sale of the property to London interests for £200,000, and out of all these transactions their final net profit of at least £270,000 sterling from an original "gamble" of seven thousand Mexican pesos, takes some beating even in mining.

One of the nearest things to it—though still more profitable—is the history of the old South Caradon copper mine about three miles from where I am now writing here in Cornwall: started by two working miners and upon a total capital of only £627—say $3,000—it produced and sold copper ores to the total value of £2,400,000 and paid no less than £701,000 in dividends and £108,000 in "lord's dues." And even now there is the making of a second Dolcoath—in tin, underlying it; proved and admitted to be there below the copper, which gave out at 1,200 ft., but never worked.

At the time I write of in Mexico, Pedro Alvarado's famous Palmilla mine was "going strong." He had already sold high-grade ore to the value of $1,800,000, and a very great deal more had been stolen by his workmen—he was never hard upon them! The smelters' agents, moreover, boasted openly that they didn't pay "Pete" more than about 60 per cent of real value. I remember escorting some American friends over this property, and taking a "grab sample" in passing eighteen or twenty tons of unsacked "second-class" ore broken to the size of road metal. I had it crushed down, quartered and assayed: it yielded 3,700-odd oz. in silver, and over 90 oz. per ton in gold. In this wonderful "chimney" or "pipe" of ore I have seen faces of up to 25 ft. wide of still richer mineral. After more than twenty years this mine, at depth, is I believe still doing fine things.

At the centuries-old mine overlooking Parral town—La Prieta—I have seen "slabs" extracted of almost pure argentite of up to 100 lb. in weight. My own mine foreman with half a dozen of his Mexican relatives opened up the Bien Venida mine, in the western sierra beyond Parral, with tools and dynamite borrowed from me. Within two weeks of the first blow being struck they had exposed rich mineral and sold an eleven-ton lot of silver ore from a vein averaging 9 to 10 per cent silver across a foot width, for about 100 ft. long. I personally sampled it over that width and length during their first month's work, and later on both the size and values increased. They have become rich men and big land owners.

The foregoing are a few only of my Mexican "rich ore" experiences. The country lying upon the western slope of the high sierra, running down into Sonora, Sinaloa, and western Durango, will provide marvelous surprises, in gold especially, for really enterprising explorers during the next few years. Practically speaking (and for very sound geologic reasons) all the true gold-bearing lodes of Mexico are on the Pacific slope of the western sierra.

To wind up my experiences of high-grade precious-metal ores I may astonish your readers, but (for actual richness) I will name this old country of Cornwall for silver, and North Wales for gold. And I will do so without any fear of contradiction. I am myself opening up an adit mine 5½ miles from this town, the silver-lead ores from one of two lodes traversing it assaying over 70 per cent lead and about 130 oz. in silver per ton. Upon a third lode—gray copper and silver ore—I have driven an adit 1,000 ft., and 560 ft. of it is in ore averaging about 40 oz. silver across 2½ ft., as broken. I have had 147 oz. per ton across 5 ft., and 243 oz. across 2 ft. 3 in. It is really a fahl ore, there being about 20 oz. of silver per unit of copper: there is a little gold, a little lead, a little nickel, and a great deal of chalybite. The ore is a "breccia." with all the mineral in the secondary or cementing silica. The lodes here are in Devonian slate.

This, certainly, is not rich ore, but I preface what follows with it because it appears to be of extraordinary interest to engineers generally: who, from the amazing atrophy of all spirit of enterprise which has overtaken the English race, won't believe in its existence until they see it, because, forsooth, it is in Cornwall—only five hours by rail from London.

But three miles from where I now write, however, at the old Ludcott mine, 304¾ tons of native silver-bearing and true silver ores—argentite and ruby silver—was sold for £22,501 sterling; £73 odd per ton, *as mined.*

Extract from Transactions of the Royal Geological Society of Cornwall

Vol. VIII—Part I
W. J. Henwood on the Lead-Mines of Menheniot
Lanreath and Saint Pinnock

The following columns—compiled by John Taylor, Esq.; Purser of Wheal Ludcott, from accounts kept at the Mine—show the quantities of ore obtained from the Northernmost cross-vein, the price at which the several parcels were sold, and the proceeds of each sale.

Date	Weight (Av.) of Ore Tons	Cwt.	Grs.	Lbs.	Price per (Av.) Ton £	s	d	Amount £	s	d
1861										
Sept. 27	2	19	3	0	290	14	6	868	10	9
1861										
Nov. 13	9	2	3	0	47	6	0	431	17	10
1862	9	18	0	0	22	14	3	223	17	6
Jan. 4	23	3	3	0	2	0	6	46	18	8
Jan. 13	1	0	0	0	694	0	0	694	0	0
Feb. 22	1	4	2	0	652	10	0	799	6	3
March 1	13	5	0	0	25	7	6	336	4	4
March 2	10	0	0	0	1	7	6	13	5	0
March 27	2	0	0	0	457	4	0	914	8	0
April 3	1	2	0	0	235	0	0	258	10	0
April 9	1	18	2	0	367	6	6	707	1	0
April 9	13	0	1	0	33	15	0	439	3	0
May 10	3	10	3	8	378	0	0	1,338	10	6
June 5	20	0	2	0	31	15	0	635	15	10
July 1	3	14	2	10	464	0	0	1,730	9	4
July 1	3	12	0	0	80	15	0	290	14	0
Aug. 18	1	1	1	23	878	0	0	941	17	9
Aug. 18	3	14	1	11	380	7	0	1,413	18	3
Aug. 18	25	4	1	0	34	2	6	860	7	6
Oct. 6	3	18	3	22	382	0	0	1,507	17	6
Oct. 6	1	12	1	20	116	1	6	188	4	0
Oct. 6	32	19	1	0	9	12	0	316	8	9
Nov. 25	1	0	3	7	422	10	6	439	13	9
Nov. 25	5	7	3	8	224	10	6	1,210	8	6
Nov. 25	23	8	0	0	10	1	0	235	3	4
1863										
Jan. 5	7	2	2	0	343	16	6	2,449	15	0
Jan. 5	6	7	1	18	63	14	6	405	19	2
Jan. 5	19	9	3	0	10	2	6	197	6	2
April 6	4	11	2	6	223	9	0	1,022	17	7
April 6	3	7	1	21	35	0	0	118	0	3
April 6	21	18	3	0	9	10	6	208	19	0
April 6	0	0	2	27¾	6,048	0	0 (*a*)	226	2	6
April 6	0	0	2	18½	4,592	0	0 (*b*)	152	14	6
April 6	0	0	1	2¼	4,936	0	0 (*c*)	67	6	1
April 6	0	2	3	20	1,568	0	0 (*d*)	229	12	0
July 13	4	14	0	0	93	15	0	440	12	6
July 13	18	19	3	0	7	6	6	139	1	7
Totals	304	15	1	26½ *e*				£22,501	8	6 (*e*)
Mean					£73	16	8			

(*a*) £2.14.0 per lb. (Avoir.) (*b*) £2.1.0 per lb. (Avoir.) (*c*) £2.4.6 per lb (Avoir.) (*d*) £0.14.0 per lb. (Avoir.).

The accompanying extract from Volume VIII of the Transactions of the Royal Geological Society of Cornwall gives these sales in detail. As will be seen, several "lots" of a few tons apiece sold at prices up to more than £800—say $4,000—per ton; and small quantities of the native silver, almost pure metal, at the rate of £6,000, or say $29,000 per ton—at the then price of silver—about $1 to $1.25 per ounce. The lode in question is in Devonian slate also. This was fifty-nine years ago, but between the years 1907 and 1912 a little mine in west Cornwall sold silver ore—rich chlorides—to the value of about £30,000 down to a depth of only 80 ft. It is said that the stuff averaged 2,000 to 3,000 oz., and two tons, I know, assayed 11,200 oz. per ton. I have myself seen and investigated this occurrence: a big, iron-bearing quartz lode in Ordovician slate, intersected and "heaved" by acid dikes or "elvans," the rich ore, of course, being near these "faults." At

80 ft., the previously concentrated and rich chloride ore was spread over a big width of lode, and this assayed only 40 or 50 oz., though there was much of it. Those in charge actually carted this milling-grade *chloride* ore two miles, stamped it, and were surprised to find that their buddle-concentrate assayed no more than did the tailing, the silver dissolving and flowing down to the sea!

Everyone has heard of gold in North Wales, but it was my fortune, from 1900 to 1901, to have to do with the production of a sterling value of about £210,000 from the very richest gold ore ever mined, the world over. It stuck out from the white quartz in chunks of many ounces (as I have already described the San Francisco del Oro silver occurrence in lead carbonates) and assayed 1,700 to 1,800 oz. per ton. Approximately one ton was crushed in a big pan with a centrifugal roller and a whole bottle of mercury once monthly; and from this one ton came gold, 970 "fine," worth from about £7,000 to £7,500. The lode it occurred in is of hard, white quartz—in Cambrian and Silurian slate—traceable for about three miles. Very small values in copper are sometimes present, with "traces" to shilling or two per ton in gold. Very occasionally, however, these almost fabulously rich segregations of extremely coarse and nuggety gold are found—with native bismuth; the two, invariably, occur together. In this instance, for so long as ever I live, I shall not forget that little "back stope" to which there was only one entrance and exit (heavily barred by a ponderous iron door) which, in real truth, was the veritable "jeweller's shop" one often speaks of.

To wind up this over-long letter, the really *greatest* thing that I have ever seen in the mineral kingdom is that tremendous territory of almost pure iron ores in southern Brazil: several mountain ranges capped, in places, to some hundreds of feet depth by ores assaying about 69 per cent metallic iron—low in phosphorus, and with a fracture like cast steel. A string of "zeros" too long to count would not begin to touch the tonnage: it is computed, generally, at so many thousand tons "per acre per foot of depth." Over some millions of acres, and with exposures of up to 300 ft. in thickness, some idea of it may be arrived at!

This greatest of all iron fields is still debarred by absence of local coal and markets and by high sea freights from doing much today: but could we who have visualized its tremendous future return to earth when this vast area of the fertile, healthy uplands of the southern regions of South America come into their own, what sights indeed might meet our eyes! But that may not be—it is but a phantasy, a dream: *"Sic transit gloria mundi."* A. SPENCER CRAGOE.

Liskeard, Cornwall.

Costumbre de Pais

THE EDITOR:

Sir—On my last prospecting trip I took a chance and landed in the State of Sonora, Mexico, and located some rich placer ground. About the time I had enough gold dust to load my burros and start back home there arrived into my camp five husky Yaquis, horseback. I could not speak their lingo, and I knew they were a tough bunch. The looks of the muscles in their faces put me in mind of a manager that used to run the Hydrophobia mine at Tin Cup, Colorado. I never did forget this mine: the foreman growled all the time, his wife was always finding fault, their dog would bite and the cat would scratch the boarding house cook.

While my burros were "thinking" of home sweet home, I remembered that an Indian principle is said to be: "Never kill a crazy prospector." So I drew a large ring in the sand and pulled off my shirt and overalls and jumped in naked and started to swim. I went through all the motions of a person swimming over Niagara Falls.

I never will forget these kind hearted Yaquis. They escorted me and my friends the burros back to the American boundary line and gave me an invitation to pay them another visit, which I intend to do some other day.

Now don't you think it pays to study the habits, customs, and language of our southern neighbors, if we intend to trade and prospect in their country and hold their friendship? Remember you cannot catch a bee with a pick handle; it takes honey.

Kingman, Ariz. E. B. FOSTER.

Shape of Grinding Media

THE EDITOR:

Sir—In recent numbers of your publication there have been several articles in regard to the shape of grinding balls and rods. I think that the different conclusions reached by the various writers are largely due to the character of the experiments they made. Several years ago I ran a series of laboratory tests on different grinding media for portland cement. The character of this grinding, except that it was dry, would approximate in fineness that in a sliming process. The result of these laboratory tests indicated that small spheres were more efficient than either small cylinders or flat circular disks. Commercial tests with the same grinding media indicated that there was little difference in results obtained with these three shapes.

Balls give point contact only; small cylinders theoretically give line contact, while in practice point contact is probably generally obtained, as in a mill loaded with freely tumbling bodies small cylinders do not tend to arrange themselves parallel to one another; flat circular disks give a great deal of surface contact, but are objectionable on account of not rolling freely.

For preliminary grinding from 1½ in. or larger to 20 mesh, spheres seem to be more efficient than any other shape. I am the patentee of a grinding ball having concave surfaces approximately fitting the convex surfaces of similarly shaped adjacent balls in the mill, and would therefore be inclined to be prejudiced in favor of this shape. However, I have found that for preliminary grinding, this patented ball, which is marketed under the name of "Concavex," is not as efficient as a true sphere. Greater surface contact is perhaps obtained with this shape than with any other yet used in a ball mill, and I attribute the lower efficiency attained in coarse grinding to the larger pieces of rock seating themselves in the cups and offering more resistance to fracture than when caught between the convex surfaces of true spheres.

This same special grinding ball has shown remarkably high efficiency both in laboratory tests and in commercial grinding when used for fine grinding. This I attribute to the necessity of large surface contact combined with attrition for fine grinding.

Milwaukee, Wis. R. C. NEWHOUSE.

Societies, Addresses, and Reports

Silver Committee Makes Progress

Recent New York Meeting Brings Out All Shades of Opinion

By F. E. Wormser
Assistant Editor

ON Nov. 14, 15, and 16 a committee of silver producers met at Waldorf-Astoria Hotel, in New York City, to discuss ways and means of forming an association that would better their position in the world market. This committee was an outgrowth of the conference held in Reno last September, where a convention of silver miners and smelters postponed deliberations pending the investigations and recommendations of the appointed body which was to meet at the Waldorf.

Although the committee was small in numbers, the committeemen present represented companies producing fully 90 per cent of the silver production of the United States. C. F. Kelley, president of the Anaconda Copper Mining Co., acted as chairman, smoothly piloting the business of the group to its conclusion. The committee's personnel attending the meeting were W. Mont Ferry, Silver King Coalition; F. Y. Robertson, U. S. Smelting, Refining & Mining Co.; F. H. Brownell, A. S. & R. Co.; Fred Carroll, Atlas Mining & Milling Co.; Charles Bocking, Butte & Superior Mining Co.; Alfred Harrell, California Rand Silver, Inc.; E. J. Raddatz, Tintic Standard Mining Co.; R. E. Tally, United Verde Mining Co., and Dr. S. A. Holder, Asia Banking Corporation. J. F. Callbreath, secretary of the American Mining Congress, and H. N. Laurie, assistant to the Commission of Gold and Silver Inquiry, participated in the discussion. Not only did the committee hear expression of opinion from small and large miners and smelters, but it also invited comment and suggestions from bankers, silversmiths, dealers, government officials, mining associations and consumers. All of them had their say and were requested to speak frankly before the committee, with the assurance that their remarks would be held in confidence should they so desire.

It soon became apparent that many difficulties stood in the way of the achievement of the principal object of the meeting—the formation of an export association. The obstacles were mainly of a legal nature. It was felt in the first place that an export organization would be hampered by the failure to include Canadian producers in it. Furthermore, the custom smelters would have to be given special accord in such a body. Then again the Webb-Pomerene Act, which governs the activities of export associations, would have to be amended if the freedom that some producers demanded for a silver export association and the freedom necessary to dominate the market was allowed. The Webb Act does not permit sales to domestic consumers by export associations, but this is precisely what some producers thought could be done. The possibilities of forming a Silver Export Association that shall be virile are not bright. To control the silver market it would be necessary to control the Far Eastern exchange market, as they are both intimately related.

One of the most interesting and informative addresses delivered before the committee came from P. D. Handy, of Handy & Harman. Mr. Handy mentioned the long association his company had had with the silver business—practically a lifetime—and said that it occupied a neutral position in the silver movement. He emphasized the fact that his company was neither a producer nor a consumer of silver, but merely acted as bullion merchants. He had watched past experiments aimed at the control of the silver market invariably end in disaster to the manipulators. Mr. Handy recommended closer co-operation with the domestic consumers of silver, in order to widen the consumption of American-made silverware. He gave figures to show the growth of direct trade between the United States and the Far East in silver shipments, a promising change of recent origin. Expressions of opinion from London brokers were read. Strangely enough, they did not show hostility but a keen interest in the action that American producers were likely to take and doubt that they could achieve their object. Mr. Handy emphasized the point that every effort should be made to counteract the idea that a Silver Export Association has been formed to wrest control of the silver market from London and boost the price to a figure attractive to the miners. In his belief the keynote of success was co-operation, not antagonism. He expressed the hope that none of his remarks would be construed as unsympathetic to the formation of an export association established for the purpose of stabilizing the price and increasing demand for silver.

The Need for Cultivating Friendly Relations With the Far East

Mr. Harman supplemented the talk of his associate and recounted the history of silver since 1873—fifty years ago—which began a momentous chain of events for the white metal, beginning with the German demonetization of silver. He said that the Asiatics were our friends and that this friendship should be fostered. They could consume even more silver than they were taking today, but they favored a free and uncontrolled market. Mr. Harman showed examples of the poor quality silver coins being minted in Europe at the present time, and said that the Continental market for silver had temporarily vanished. Base-metal coins had been substituted for pre-war silver mintage. In closing he paid a tribute to the character and integrity of the four London brokerage firms and from personal acquaintance had every confidence in their methods of doing business, for he believed them to be honorable men.

The silverware manufacturers were represented at the meeting by C. W. Harman, president of the Sterling Silverware Manufacturers' Association. G. H. Niemeyer, president of the National Jewelers' Board of Trade, also spoke and helped to inject the manufacturers' viewpoint in the discussion. The highly important statement was made that silver manufacturers felt that the domestic silver market was by no means saturated, but could consume about three times the amount it was using. Stimulation of sales was necessary. The retail jewelers of the country were generally backward so far as modern merchandising methods were concerned. Silverware was being "bought, not sold." However, the industry had its own problems to solve, such as the expensive new dies that had to be made almost yearly as a result of the frequent change in styles of silverware. Although it is a common impression that the profits of retail jewelers must be high—judging from the prices asked for sterling and plated ware—still the committee was told that the Harvard Economic Bureau had come to the conclusion, after much research, that the profits of the retailers were only 2 to 3 per cent. This was owing to the small turnover and high overhead. Tarnishing of silver had long been a bugbear of the manufacturers and they had spent much time and money in trying to find an alloy that would not tarnish. Although research seemed to be welcome, it was pointed out that there were "blind alleys" up which some contemplated research might go and that it should be carefully done to get the best results.

The meeting throughout was noticeable for its lack of friction among the groups represented. A noteworthy effort was shown to pull together, and both mining and smelting groups more than once showed a disposition to subordinate their interests and to do whatever the other element thought fair and equitable after hearing all sides of any particular point.

Owing to the necessity of obtaining further information relative to the attitude of the government toward an organization of silver producers, the committee arranged a meeting with Secretary Hoover in Washington on Nov. 19, where the problems of the producers were outlined. It was decided after the trip to Washington that no statement should be made by the committee until a digest had been prepared and a rather full report compiled for submission to the convention of American producers which W. Mont Ferry is expected to call early next year.

The committee as a result of its meeting received many helpful suggestions which will prove useful when the time comes for formal action.

Recent Technical Publications

Reviews, Abstracts, and References

Stansfield's "Electric Furnace" Entirely Rewritten

The Electric Furnace for Iron and Steel. By Alfred Stansfield. McGraw-Hill Book Co., New York. Price, $5.

The use of the electric furnace in the iron and steel industry has expanded so rapidly and is now of such great industrial importance that a book devoted entirely to the subject is timely. This book, like Stansfield's "The Electric Furnace," will probably be the standard text and reference for the subject covered, for a long time. It is written clearly enough for the student and in sufficient detail for the experienced electric-furnace operator.

The book is an enlargement of the chapters on iron and steel contained in Stansfield's "The Electric Furnace," and is divided into three parts. Part I, being introductory, discusses briefly the history of the development of the electric furnace for iron and steel, the fundamental principles of iron and steel metallurgy, and the subject of electrical supply. The chapter on electrical supply is exceptionally well done and will be of inestimable value to both students and operators who are not well versed in electrical engineering fundamentals.

Part II describes the electric smelting of iron ores to produce pig iron, the reduction, without fusion, of iron ores to metallic iron for subsequent conversion into pig iron by electric melting, and the production of ferro-alloys in the electric furnace. A great deal has been written, heretofore, tracing the development of the various types of electric furnaces used in smelting iron ores, but most of it is contained in government reports and European publications that are not accessible to the ordinary reader. Stansfield has presented a clear and interesting story of this development and gives details of the construction, operation, results, and production costs of the important furnace types.

In his discussion under "Principles of Electric Iron Smelting" it would have been better to have given the results of the more recent work on the reduction of iron oxides by carbon and carbon monoxide rather than those of Bauer and Glaessner and of Boudouard, which have been greatly improved upon by more recent investigators.

Under "Indirect Electric Smelting of Iron Ores" Stansfield calls attention to the possibilities of making pig iron by reduction of iron ore with carbonaceous material at a temperature low enough to avoid fusion, and subsequently melting the metallic powder so produced. Theoretical advantages of this procedure over straight smelting methods are pointed out and a brief review of some of the past attempts at indirect smelting is given. Sufficient examples to prove the metallurgical feasibility of the proposed process are not given, and, hence, not a good case is presented for indirect smelting. This subject (Indirect Electric Smelting) is not portrayed in the complete, convincing manner that characterizes the other parts of the book.

The chapter on "Ferro-alloys" presents a condensed review of the literature on the subject, most of which was published in the technical literature appearing in this country during and after the World War. It is unfortunate that more information has not been published by large operators describing the design and operation of efficient ferro-alloy smelting furnaces, because such information would be valuable in this book.

Part III is confined largely to steel. It discusses the production of steel and iron in the electric furnace from metallic materials, and describes the application of the various types of electric furnaces to steel making. Typical examples of melting operations are given, showing the various methods used. Much space is given to the design of numerous furnaces used or proposed for use in making electric-furnace steel. These furnaces include many types that have been abandoned by the manufacturers, but their description is valuable in this treatise from both a historical and practical standpoint. An important feature of this section is the liberal use of illustrations of furnaces and records of operation. After reading the 200 pages devoted to this subject, one feels that he has actually passed through the development of the technique in the production of steel in the electric furnace from its beginning to its present efficient stage.

CLYDE E. WILLIAMS.

A New Book on Motor Fuels

Motor Fuels. By Eugene H. Leslie. Chemical Catalog Co., Inc., New York. 681 pp.; illustrated. Price $7.

This treatise should appeal to several classes of readers. The author explains that it was planned (1) for the student who knows little or nothing of refinery technology and who will find the general and descriptive matter essential to gain a picture of the industry; (2) for the non-technical reader, who is not concerned with the principles of distillation, fluid flow, or thermal decomposition, of hydrocarbon, but who may be interested in the motor-fuel situation, the processes used in refining petroleum, the quality of motor fuel, the future possibilities of alcohol, and so on; and (3) for the refinery engineer, who will find a presentation of the fundamental principles of distillation, fluid flow, heat transfer, thermal reactions of hydrocarbons, and refining.

The opening chapter deals with the motor-fuel problem, in connection with which the author quotes Dr. George Otis Smith's remark that "The motto on our silver coins should hardly be made a national policy in providing a future oil supply." Professor Leslie does not mince words in warning of the dangers ahead. The growth of the automotive industry is emphasized by statistics and charts, which show the enormous increase that has occurred in recent years in the consumption of gasoline. The *Financial News* of London is quoted as authority for the statement that Great Britain commands no less than 75 per cent of the world's oil resources—a boast that was interpreted in most quarters, one might interpolate, as journalistic braggadocio; E. Mackay Edgar's oft-repeated statement made in 1919 is featured—that "before long America will have to come to us (Great Britain) for the petroleum she needs"; and David White's article, in *Engineering and Mining Journal* of April 2, 1921, is used to emphasize the seriousness of the situation. The present and future need for the importation of oil into the United States has prompted the publication of statistics and maps that give the location and quantity of the reserve in other parts of the world.

Chapters II to XI, inclusive, deal with technicalities, including details of the manufacture of petroleum products, equipment, thermal reactions, cracking processes and gasoline production.

Chapter XII is of general interest, because it discusses alcohol as a motor fuel. The disadvantages of this substitute for gasoline are enumerated, although clean combustion is cited as a point in its favor. A section dealing with "Alcohol and the Law" is informative and readable; it will be appreciated alike by the layman and the technician.

The manufacture of alcohol from cane and beet, molasses, corn, potatoes, artichokes, cassava, sulphite liquor, ethylene, and acetylene is described. After an exhaustive survey of possibilities, the author considers that wood appears to be the most likely raw material, and subsequent chapters deal with composite motor fuels, gasoline purification, distillation in the laboratory and methods of analysis. A large number of tables and much data of value for reference purposes are appended.

A. W. ALLEN.

Technical Papers

Alaska's Resources—Bulletin 739 of the U. S. Geological Survey is entitled "Mineral Resources of Alaska" and is a report on the progress of investigations in 1921.

Fine Grinding—A new view of grinding in ball and pebble mills is given by Alfred T. Fry in a paper entitled "A Supplementary Theory of Fine Grinding," which is published in the Aug. 5 issue of *Chemical Engineering and Mining Review*, Melbourne, Australia. According to the author, the theory is independent of those of Kick and Rittinger.

MEN YOU SHOULD KNOW ABOUT

H. L. Percy, president of the Magistral Ameca Copper Co., Mexico, is in New York.

William B. Case, mining engineer, was in New York last week and has gone to Tulsa, Okla.

J. A. Burgess, consulting engineer of San Francisco, is at the Consolidated Cortez mine, in Nevada, on professional business.

H. D. Budelman, mine superintendent of the West End and Halifax mines, in Tonopah, has returned to Tonopah from Los Angeles.

George W. Wigton, metallurgist, Chief Consolidated Mining Co., Eureka, Utah, has been in New York City for the last two weeks.

George H. Garrey has just completed a detailed geological examination of the mines of the Cinco Minas Company, at Magdalena, Jalisco, Mexico.

J. H. Sharman, of London, Ont., has returned from northern Quebec, where he and his associates have secured an extensive mining property west of Lake Fortune.

Charles E. Herron, of the *Anchorage Daily Times*, the *Alaska Weekly*, and the *Hyder Miner*, has left New York for San Francisco, on his way to Seattle, Wash.

W. A. Heywood, metallurgist, of London, arrived in New York on the "Majestic" on Nov. 21, and will be in the United States for a few weeks on professional business.

A. S. MacNeil has been appointed superintendent of the mines of the British Empire Steel Corporation, and **Walter Herd** has been made chief mining engineer of the company.

Frederick Marston has resigned as mill superintendent for the Tennessee Copper Co. to accept a similar position with the San Francisco Mines of Mexico, Ltd., Parral, Chihuahua, Mexico.

E. F. Salisbury, mining engineer, has been appointed assistant general manager of the International Ore & Smelting Co., and will be in charge of that company's mining and ore departments.

William Watson, of London, who has spent the season in the Ymir district, British Columbia, recently examined the Albion, Krao, Tariff, and United mines, in the Ainsworth district, for English interests.

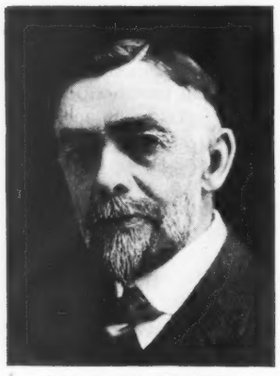
Dr. Charles Camsell, deputy minister of mines in the Dominion Government service, recently arrived in Canada after a three months' visit in England and other parts of Europe.

A. B. Shepherd and **W. F. Moreland**, of Pittsburgh, Pa., and **Mark Elliott**, of Virginia, Minn., have completed a tour of inspection of the properties of the Jones & Laughlin Ore Co. in the Lake Superior region.

Gelasio Caetani, Italian Ambassador, on Carnegie Day (Nov. 23) addressed the students of Carnegie Institute of Technology at Pittsburgh. His theme was the Fascisti movement in Italy, and how it checked sovietism.

S. C. Ells, of the Canadian Department of Mines, has completed a survey of the tar sands along the Athabaska River in Alberta, having mapped out an area of about 1,200 square miles, most of which contain tar sands.

Dr. F. W. McNair, president of the Michigan College of Mines, at Houghton, Mich., was in New York recently to attend a meeting of the board of investigation and co-ordination of the



Dr. F. W. McNair

Society for the Promotion of Engineering Education. He was accompanied by **Prof. M. E. Cooley**, dean of engineering at the University of Michigan.

J. D. Hill is head of the department of English and Spanish at the New Mexico School of Mines, Socorro, N. M. Mr. Hill was formerly employed at the Gulf Coast Military Academy in Mississippi as head of the department of languages.

W. J. Douglass, superintendent of the Tonopah Midway mine, one of the pioneers of Tonopah, and one of the best-known mining men in the State of Nevada, has returned to Tonopah after an absence of four months due to a fractured leg.

E. V. Lowe, director of the Mississippi Geological Survey, has during the present year concluded investigations covering the mapping of the stream valleys of the state and a reconnaissance of Mississippi's natural resources of oil, gas, bauxite, and water-power.

Emil E. Dieffenbach, general superintendent of the Balbach Smelting & Refining Co., was the guest of honor at a dinner given at the Robert Treat Hotel, in Newark, N. J., on Nov. 20, by the officers and directors in honor of Mr. Dieffenbach's forty years' connection with the company.

Dr. Frederick M. Becket is to receive the Perkin medal, awarded annually for the most noteworthy achievement in applied chemistry. The presentation will take place at a meeting of the American Section of the Society of Chemical Industry, at the Chemists' Club, New York, on Jan. 11.

George S. McCaa, the engineer in charge of the Mine Safety Service of the Bureau of Mines, has resigned to enter private employment. Among other things, Mr. McCaa developed the half-hour type breathing apparatus for the Navy. He is recognized as one of the foremost research men specializing on oxygen breathing apparatus.

Representative Louis C. Cramton, of Michigan, the chairman of the subcommittee on appropriations for the Interior Department, has been spending a week at the Pittsburgh station of the Bureau of Mines. That he may be fully acquainted with the activities of the Interior Department, Mr. Cramton has spent a large part of the interim between Congresses in familiarizing himself with the field work and experiment station work of the various bureaus.

Rowland F. Hill, of the consulting firm of Emerson & Hill, 60 Wall St., has returned to Mexico to continue development work at the Magistral and Las Moras properties, near Ameca, in the State of Jalisco. This property promises to develop a large tonnage of low-grade copper ores, which cement an extensive breccia. The chief ore mineral is primary chalcopyrite. The ore occurs largely in andesite with an apparent association with granitic intrusives, and is overlain by later andesite flows. Microscopic work on the ores has been done by Professor Kemp and Berkey, of Columbia University.

OBITUARY

James McAllister, a Klondike pioneer, and at one time a wealthy mining operator, died at Dawson, Yukon, on Nov. 21. Mr. McAllister was seventy-seven years old.

Major Neil R. MacDonald ("Foghorn" MacDonald), one of the most picturesque figures in the Canadian mining industry, died in Montreal at the age of sixty-five, on Nov. 22. His military title was acquired in the World War, which he entered as a private in the Engineering Corps, of the First Princess Pat expedition. His services in Flanders were brilliant.

"Foghorn" MacDonald was known in many of the mining camps of North America as a fearless explorer, a prince of good fellows, and a friend of man. His personality and booming voice commanded attention in any gathering. He was particularly famous for his rendition of "Drill Ye Tarriers Drill" at the annual meetings of the Canadian Institute of Mining and Metallurgy.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary of the Week

OFFICIALS of the Dome Mines, Ltd., after a visit to the mine, declare that there is "more ore in sight than ever before."

As a consequence of the completion of Pittman Act silver purchases, profits of the Chief Consolidated Mining Co., in Utah, have declined.

William Kelly, veteran mine operator of the Michigan iron region, will be next president of the A. I. M. E.

Mines in Nayarit and Jalisco will get hydro-electric power from a new plant near Guadalajara, Mexico.

Results of deep development in both the Cresson and Portland mines, in the Cripple Creek district, are awaited with interest.

The A. S. & R. Co. has optioned the American Beauty lead-silver mine, situated near Elko, Nev.

The United States S. R. & M. Co. has arranged to operate the New Sutherland Divide mine, in California, on a proceeds-sharing basis.

The recent discoveries of lead-silver deposits in Queensland, Australia, continue to show up well with development.

The Mohawk Mining Co. has acquired 480 acres of land on the Kearsarge lode in the Michigan copper country.

Ore from the Rossland mine, in British Columbia, is now being concentrated in the Trail plant of the Consolidated Mining & Smelting Co.

An additional award of $48,748 has been recommended by the War Minerals Commission to the Pine Creek Tungsten Co.

William Kelly Will Succeed Mathewson as A.I.M.E. President

Veteran Manager of Michigan Iron Mine—De Golyer and Merrill Named Vice-presidents

William Kelly, of Vulcan, Mich., has been nominated to succeed E. P. Mathewson as president of the A. I. M. E. for 1924, declares an official announcement. As vice-presidents and directors, Everette L. De Golyer, geologist of New York City, and Charles W. Merrill, metallurgist of San Francisco, were named. The following directors were selected: R. V. Norris, engineer, of Wilkes-Barre, Pa.; George Otis Smith, of Washington, director of the U. S. Geological Survey; P. B. Butler, mine operator, of Joplin, Mo.; B. D. Quarrie, steel manager of Cleveland, Ohio, and L. D. Ricketts, engineer, of Warren, Ariz.

Mr. Kelly, long manager of the Penn Iron Mining Co., is widely known among American engineers, and a leading figure in the industry. He was born in New York City in 1845, and received his B. A. from Yale in 1874 and his E. M. from Columbia in 1877. He has been identified with mining enterprises in Ohio, Pennsylvania and Michigan, and with education, banking and a state administration in Michigan. In 1916 he was a delegate to the Republican national convention. He is a member of the Institution of Mining and Metallurgy of London.

Possible Iron Land in Missouri Brings $73 Per Acre

W. I. Hooper, of Poplar Bluff, Mo., on Nov. 21 announced the sale of 11,000 acres of land in the Iron Mountain district of Wayne County, Mo., to I. W. Rodgers and H. E. Springer, of Poplar Bluff, for $800,000. The new owners are said to contemplate mining iron. Recently operations were resumed at the old Iron Mountain property, which had been idle for more than a quarter of a century. The land involved in the present transaction is situated near Iron Mountain holdings.

Rumor of Litigation Between Anaconda and Senator Clark

OUTSIDE engineers and geologists from various parts of the country have been in Butte, Mont., recently. Though no authoritative statement is forthcoming from any of the interested parties, it is believed in Butte that Senator W. A. Clark contends that the Anaconda Copper Mining Co. has wrongfully mined a large quantity of ore from veins that apex in his Elm Orlu property. The value of the ore involved is said to be $5,000,000. Four years ago the Clark interests settled litigation with the Butte & Superior Co. by accepting $2,500,000 in cash for ore that was mined and milled by the latter company.

Mohawk Gets 480 Acres of Land on Kearsarge Lode in Michigan

Situated West of Wolverine — Should Prolong Life of Company—No Sinking for the Present

Through negotiations concluded with the Sheldon-Douglas interests and the Union Land Co., the Mohawk Mining Co. has come into possession of 480 acres of mineral-bearing land lying to the west of the Wolverine property, in the Michigan copper district. Options on this tract were held by the Wolverine Copper Mining Co. and were taken over by Mohawk upon consolidation with Wolverine and Michigan. An intervening tract of 80 acres is owned by Calumet & Hecla Consolidated, being part of the old Osceola holdings. Of the 480 acres, 160 acres were acquired from the Sheldon-Douglas estate, and 320 acres, to the north and east, from Union Land.

The highly productive Kearsarge lode underlies all of this acreage, and can be worked to a depth of 10,000 ft. The acquisition is considered most important in the prolongation of the life of the Mohawk company, in which the former holders of Wolverine and Michigan stock now have an interest. It is unlikely, however, that any exploratory work or shaft sinking will be done in the new tract until there is a considerable improvement in the metal market. Development of the tract holds interesting possibilities.

Construction of Railroad Revives Contact District in Nevada

Oregon Short Line Will Complete Project by June, 1925—Gray and Bellevue Drive Long Tunnels—Ore Carries Copper, Gold, and Silver

ASSURANCE of railroad transportation with the completion of a line from Rogerson, Idaho, to Wells, Nev., has stimulated mine development in the Contact copper district situated in the northeast corner of Elko County, Nev. The claims already staked cover a rectangular area approximately six miles in a north-south direction by twenty-five east and west. Schrader gives the formation as a granodiorite batholith intruded in the Paleozoic sediments and traversed by syenitic and lamprophyric dikes.

The district, with its principal community, derives its name from the contact of the granite with the limestone, which is the locus of the principal orebodies. Contact-metamorphic, fissure, and replacement deposits have been found. Lindgren, Purington, Bailey, McArdle, and Schrader have contributed to an understanding of the geology. The gold and silver content of the ore is important.

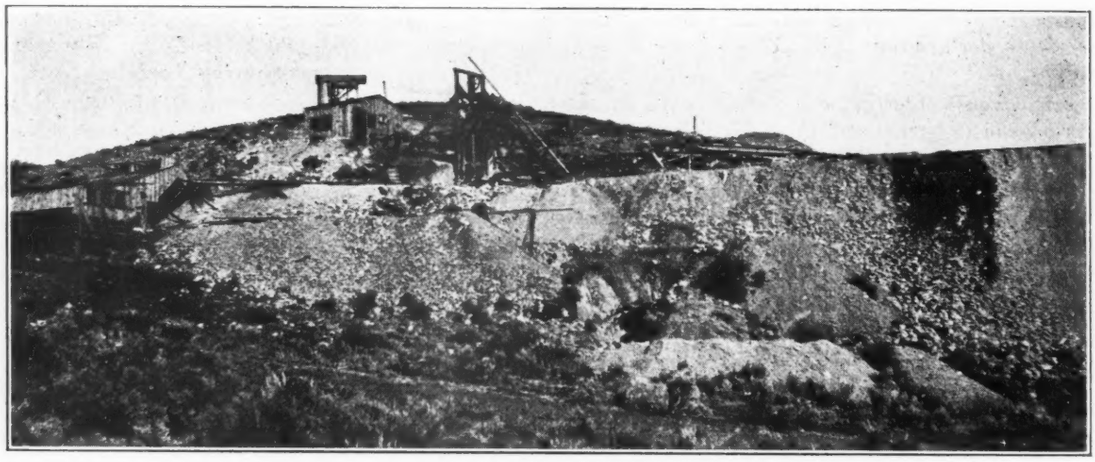
The earliest claims of record are those of 1870, and with the successive locations the total number of discoveries is about 2,000, represented by patented and unpatented claims.

The first shipment of ore was made to Swansea, Wales, by way of Boston, in 1870. In 1896 a smelter was erected; this was abandoned owing to excessive inbound transportation charges. During the war sorted ore to the amount of $250,000 was shipped to the Salt Lake smelters. The development work thus far accomplished by the Nevada-Bellevue, Gray, Brooklyn, Delano, Javan, and Riverside mining companies indicates faith in the district.

The absence of a railroad and the consequent high transportation costs has been a serious problem. Hauling forty miles north to Rogerson, Idaho, or fifty-five miles south to Wells, Nevada, by truck costs $9 to $12 a ton. On July 21, 1923, the Interstate Commerce Commission granted to the Oregon Short Line Railroad Co. permission to construct a standard-gage railroad from its stubbed branch at Rogerson to Wells, a distance of 97.7 miles—the road to be in operation by June 30, 1925. Engineers are now engaged at the work.

With this assurance of transportation the Gray Mining Co. has started a four-mile tunnel that will prove the ground at depth to a greater extent than heretofore. The Nevada-Bellevue is driving a long adit and is likewise preparing plans for a concentrator. Nearly all properties, both great and small, are either undergoing reorganization or preparing for more intensive development work.

The building of a good hotel of seventy-five rooms; enlargement of the existing water system; the laying of sewers, and the construction of a high-tension power line from Filer, Idaho, are either projected or under actual construction.



Workings of the Nevada-Bellevue, one of a dozen promising prospects in the Contact district

Contact, Nev., is a potential copper district that has been held back by lack of railroad connections

Vipond Mill To Be Started

The Vipond mill in the Porcupine district in Ontario is being put in condition to begin operations, and it is expected that it will be put in operation within the next two weeks. Important alterations have been made to this mill, which is now estimated to have a capacity of 150 tons a day. Underground developments continue satisfactory, and it is believed that the mill heads will average $10 per ton.

A. S. & R. Co. Options American Beauty Mine, Near Elko, Nev.

The American Smelting & Refining Co. has taken an option on the American Beauty silver-lead mine, thirty-four miles southeast of Elko, Nev. Though the purchase price is not stated, it is said that a substantial payment on the option has been placed in an Elko bank, and that the transaction involves an amount approximating $100,000.

The American Beauty has been developed sufficiently to establish existence of a large vein running well in lead, and arrangements have been made by the owners for commencement of shipments early in December at the rate of 100 tons weekly. Fifty men will be employed. By the summer of 1924, the property is expected to furnish work for 200 more miners.

Simon Silver-Lead Reorganizes and Levies 3c. Assessment

A meeting of stockholders of the Simon Silver-Lead Mines Co. was held in Mina, Nev., on Nov. 12. Previous reports were partly substantiated, the company was reorganized with 3,000,000 shares, par value $1, the stock made assessable, and an assessment of 3c. per share levied, the purpose of the assessment being to pay off indebtedness and to finance special development. As soon as the assessment funds are available the new shaft is to be sunk for the stated double purpose of developing ore and water. October output was 470 tons of lead-silver concentrate carrying 60 per cent lead and 37 oz. silver per ton, and 360 tons of zinc concentrate carrying 48 per cent zinc and little silver.

"Desert Rats" Build Tent City Southeast of Goldfield

Early days of Goldfield are recalled by the springing up of a miniature tent city between the old Nevada camp and the Moose claims, eight miles southeast of the town. Nearly a hundred tents are scattered over the numerous claims being prospected, and some promising discoveries have encouraged the hardy "desert rats" to further efforts.

So far mining in the new section east and southeast of Goldfield is confined largely to surface showings, but at one or two points developments have attained fair depths.

Silver-Lead Discoveries in Queensland Promise Big Things

Outcrops Cover Large Areas—Shipments Being Made to Chillagoe Smelters—"Vast Quantities" of Ore, According to Government Officials

By Our Special Correspondent.

THE MATTER of paramount interest in Queensland mining just now (written Oct. 22) is the late discoveries of the two large silver-lead deposits—one in the Chillagoe and the other in the Cloncurry field. So far, the "shows" have been explored to a depth of not more than 20 ft. on the outcrops, and no one can say to what depth the orebodies will persist; but the official geologist who has reported on the Chillagoe find, now called the Nightflower, says the indications are extremely encouraging for the persistence of silver values at depth as far as this orebody is concerned. He also states that over the whole length of the 7,000 ft. of outcrop no sample devoid of silver has been broken off. This outcrop was discovered in June last by two aboriginals, after many white men prospecting the same country for many years had missed it.

Belt Five Miles Long and a Mile Wide

The Mines Department's warden of the Cloncurry mineral field has reported on the silver-lead discovery in that district, named the Mount Isa. He confirms previous reports that what he calls "the argentiferous and plumbiferous belt" occupies an area five miles long by one mile wide, and that the ore seams over this belt carry extremely high silver values. Every holding that is being worked is on payable ore, and the warden says there is every indication of vast quantities of such ore being obtained. At this camp water is very scarce in the present dry season. The nearest permanent supply is an artesian well 6 miles away, and the nearest railway station is 64 miles distant. That station (Duchess) is 550 miles by railroad from Townsville, the nearest port.

Not a "One-Man" District

The Minister for Mines in the labor government now in power, in response to a request from the Cloncurry section of the labor federation, has decided to limit the holdings on the Mount Isa field to one 10-acre lease for each man. This has caused an outcry from other sections, which declare that the field is not a "one-man show," and that the cost of developing the field and providing a treatment plant as well as other machinery and requisites can only be found by a strong combination with adequate capital. A protest against the Minister's edict is therefore to be sent to headquarters.

W. H. Corbould, who happened to be in Queensland at the time, and who for thirteen years represented the Mount Elliott company at Cloncurry, has visited the Mount Isa field, and is said to be favorably impressed with its possibilities. Other engineers have looked over the field and declare that the prospects are excellent for the development of large orebodies.

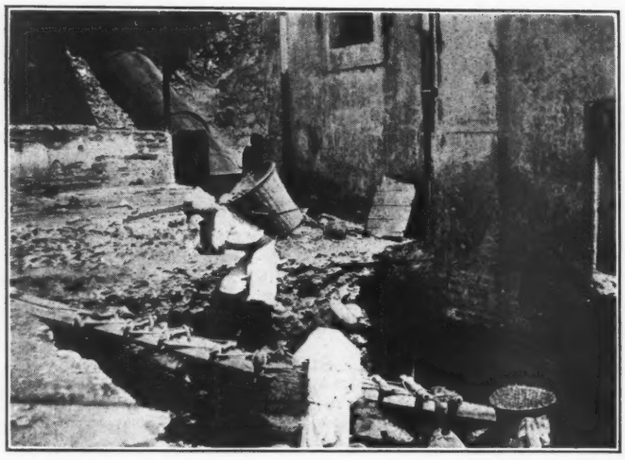
State Smelter Still Busy

The silver-lead ore from both the Cloncurry and Chillagoe fields is at present being sent to the state smelters at Chillagoe, but these smelters are so far distant from the Cloncurry that only ore of the highest grade from this region can be sent so far afield, and local crushing and concentrating machinery must be provided profitably to develop this new field. The state Premier lately stated that there would be enough ore supplies coming forward to keep the Chillagoe smelters going for an indefinite period. He did not say, what has since been made public by the Auditor General, an officer of Parliament, that the loss on this state undertaking for the last financial year was £58,793, and that the accumulated loss to date is £178,656. In order to help keep the smelters going, the government has secured for itself a considerable block of the silver-lead country on the Nightflower outcrop.

Gwalia Consolidated, in Australia, May Be Re-equipped

J. McDermott, general manager of the Ivanhoe mine, at Kalgoorlie, Australia, has made an offer on behalf of London financiers to raise £300,000 to develop the leases of the Gwalia Consolidated, at Wiluna, Lakeway district, East Murchison gold fields. The field lies about 200 miles north of Leonora and 110 miles east of Meekatharra. These two towns are the nearest railway centers. Practically no work has been done on the Gwalia Consolidated leases since 1913, when the Howe volatilization process was tried out with unsatisfactory results. A practicable metallurgical process for treating the ore is necessary for successful operation.

According to a report by A. Montgomery, the State Mining Engineer of Western Australia, the mine has been critically sampled and inspected by reputable mining engineers, and they agree in regarding it as of promise, with large reserves of somewhat low-grade yet payable ore. It is understood that Mr. McDermott has carried out some experimental work justifying the re-equipment of the property and that a definite offer has been made to the government to spend the necessary capital if railway communication is provided.

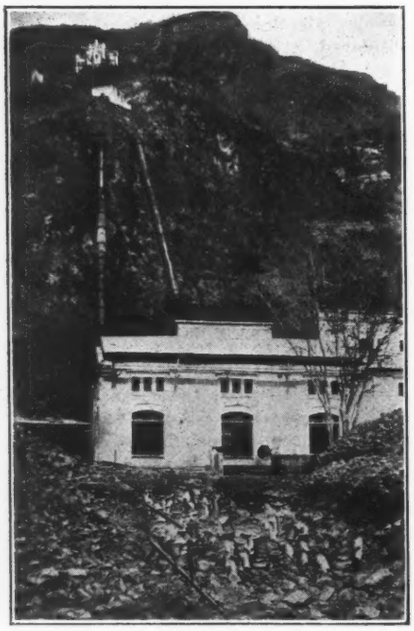


Excavation for the new spillway for the power plant at Barranca de Oblatos

The incline railway leading to the power house has a grade of 82 per cent at this point

Two Options on Murray Mogridge Property at Same Time

Difficulties are understood to have arisen in connection with the option on the Murray Mogridge property near Bourkes Siding, Ont., which is held by the Tonopah Mining Co. of Nevada. Some months ago power of attorney was given to one of the officials of the Murray Mogridge in negotiating a deal with English interests. Subsequently this power of attorney was revoked and other officials of the company gave an option to the Tonopah Mining Co. It is understood, however, that the English people with whom the deal was negotiated refuse to recognize this cancellation and insist on the validity of their agreement. The property is believed to have considerable merit, and it is understood that both companies are prepared to develop the property if the legal difficulties can be settled to determine the proper aptionee.



Power house and excavation for the new spillway

New Hydro-electric Installation Will Supply Power to Mexican Mines

Nayarit and Jalisco Benefit—Inclined Railway Constructed Under Unusual Conditions—6,000 Kw. Generated

By Henry M. Payne

THE power plant of the Cia. Hydro-electrica y Irrigadora de Chapala, S. A., originally built by French interests in 1898, at Huentitan, near Guadalajara, Mexico, has recently been greatly enlarged. Lake Chapala, the largest lake in the republic, lies 30 km. east of Guadalajara at an elevation of 5,160 ft. Its overflow forms the Rio Santiago, which, passing over the Falls of Juanacatlan, the Mexican Niagara, then flows through a gorge 2,000 ft. deep, which at Huentitan is called the Barranca de Oblatos, and is frequently likened to the Grand Canyon of the Colorado. At this point the power station of the company is situated. It is supplied by a canal 3 km. in length along the side of the gorge, giving a head of 65 m. at the point of delivery.

The plant supplies not only light and power for the city of Guadalajara and its street railway system, but by means of a network of transmission lines up to 150 km. in length, many of the largest mines in the states of Jalisco and Nayarit, including those of the Amparo, Mesatas, Cinco Minas, Marquetas, Buenos Ayres, Piedra Bola, El Favor, and Casados companies. Additional lines are being extended in the State of Nayarit to meet the mining development coincident with the completion of the Sud Pacific de Mexico between Tepic, Ixtlan del Rio, and La Quemada, and the increased demand for power necessitated the addition of larger units than those at present in service.

A 6,000-kw. Westinghouse generator and hydraulic turbine of the same capacity, with transformers and complete accessories for their installation and operation, were brought from the railroad at Guadalajara to Huentitan, from which point it was necessary to lower them to the bottom of the gorge. A standard gage inclined railway 4,357.5 ft. long was built. It contained various curves both vertical and horizontal, and two bridges. The difference in elevation of the terminals is 1,705 ft.

A Lidgerwood hoist operated by a 125-hp. G.E. motor is installed at the top, with 1⅛-in. Hercules wire rope, designed to hoist five tons or lower fifteen tons, and a special car with I-beam frame and drawbar is used for transporting the equipment, the heaviest piece of which, loaded, weighs fifteen tons. Several unique devices were employed in the construction of

The incline has various vertical and horizontal curves

the road. On the maximum grades it was necessary to hold the ties in place by ropes hitched around each end as shown in the photograph, while the rails, bent vertically, were sprung and spiked. Much difficulty was encountered from the sway of the heavy rope and the backlash when the car was brought to a standstill. To obviate this, strong frames of pipe with an overhead roller were securely anchored at the center of the swags.

The usual track rollers were installed as well as those at the inside of the

Cables were used to keep the ties in place

curves. The track was anchored on the grades by groups of ¾-in. round iron tie rods angled upward and secured in the rock at the side.

The work was carried on under the direction of H. S. Foley, chief engineer of the company, and Walter Neal, resident engineer. An automobile road has been built from Guadalajara to Huentitan, and sightseers will visit the site of the inclined tram.

Utica Mines, Ltd., Closes Deal With H. H. Armstead

Stockholders of the Utica Mines, Ltd., on Nov. 5 ratified the action of the company in entering into an agreement with Colonel H. H. Armstead for the organization of a new company to operate the mine. The Utica company will cease to exist. The mine, which is situated near Kalso, B. C., has produced sensationally rich ore on various occasions, one lessee in 1921 having taken out about $100,000 in a short time. The new operators say frankly that the "gamble" is whether or not the ore will continue at greater depth. To prove this point they will drive a number of tunnels to undercut the vein.

Await Results of Deep Development in Cripple Creek

Both Cresson and Portland Companies Are Approaching Ore on Lowest Levels—Outcome Important

Mining men at Cripple Creek, Colo., are watching with much interest development work which is being carried on at the lower levels of the Cresson and Portland mines. Both companies are drifting from points recently sunk from the main shaft to open up oreshoots on lower levels.

The Cresson company has completed the installation of pumps on the 18th or bottom level, and has started the drift for the oreshoot. The Portland will soon have its pumps in place on the 27th level, and already has made good progress toward the point where the company expects to encounter the oreshoot.

The ore in both properties has shown a steady improvement with depth. The 26th level of the Portland was much better than the 24th, both in value and size of the oreshoots, and much speculation prevails as to whether the increase in values will continue on the new levels. Orebodies on the 17th level of the Cresson are proving up nearly double the size of the same stopes that were found on the 16th, and should the same improvement continue to the 18th level, the ore reserves would be assured for many years longer.

Tonopah Belmont Considers Deep Exploration

Geologists of the Tonopah Belmont Development Co., in Nevada, are making a complete geological résumé of the Belmont mine workings, and it is possible that deeper development will be tried. The main Belmont shaft is almost 1,700 ft. deep, but little work has been accomplished below the 1,400 and 1,500 levels, as the veins became low grade at this depth.

U. S. Smelting Co. Takes Over California Lead Mine

The U. S. Smelting, Refining & Mining Co. has entered into a contract with the New Sutherland Divide Mining Co. whereby it will operate the latter's lead mine in Inyo County, Calif. The agreement provides that 51 per cent of the profits shall go to the smelting company. The mine has a record of producing 1,950 tons of metallic lead and 97,000 oz. of silver during the World War, at a time this country needed both metals so badly. In addition it has placed broken ore on the dumps in the amount of 10,000 tons averaging 19 per cent lead and 9 oz. silver per ton, which at present prices for the metals should net a good profit. The building of a railroad to the property is being considered. If the project goes through mining operations and development work in the district will be stimulated greatly. Many outcrops in the vicinity have been prospected.

Dome Has "More Ore in Sight Than Ever Before"

So Admit Directors, After Personal Scrutiny—Power Situation Much Improved

Directors of the Dome Mines Co., who recently visited the company's property in the Porcupine district in northern Ontario, express themselves as being particularly well satisfied with the condition of the mine. They state that there is more ore in sight than at any time in the history of the property, and that the lower level developments are exceeding their expectations. They also think highly of the prospects of the Dome Extension ground, and give it as their opinion that a big mine will be developed there. Up to date the amount of development work done on this part of the property has been comparatively limited, as there has been so much work to do on the Dome ground that the management has been unable to pay much attention to Dome Extension.

It was stated that the net profit for October amounted to $230,000, which is 50 per cent more than the present dividend requirements. New certificates for shares of no par value are now being issued to the shareholders at the rate of two shares of new stock for each share of old.

The open fall, which has been general throughout northern Ontario, has resulted in an abundant supply of water for the power companies, and has practically dissipated any possibility of a power shortage during the coming winter. Officials of the Northern Canada Power Co., supplying the Porcupine camp, which has suffered severely from power shortages during the last two winters, say that they will be able to continue the present supply throughout the winter months. At present water is being wasted over the dams, as the storage basins are all full, which is in great contrast to the conditions existing at this time last year. The company also has the Sturgeon Falls plant in operation, although there has been nothing like the corresponding increase in power consumption, and it is not expected that the increased demands this winter will be great. The Northern Canada Power Co. is also behind the Quinze development, which will develop 20,000 hp. available for the mines. Officials state that the Quinze developments are ahead of schedule, and that unless unusual and entirely unexpected delays are experienced, power from this source will be available for Porcupine next summer.

Goldfield Deep Mines Shaft Has Reached 1,515 Ft.

The shaft of the Goldfield Deep Mines Co., at Goldfield, Nev., is now 1,515 ft. deep, which means that an advance of 95 ft. has been made since resumption of sinking after completion of concrete work in the shaft. No changes in conditions or formations have been reported.

Good Lead-Silver Ore Shipped from Steele Property

Mill Planned if Development Continues Encouraging—Vein Is 2 Ft. Wide

The shipment of several carloads of ore to the Trail smelter in recent months from the Steele claims, owned by the Alice Arms Holdings Co., Ltd., of Vancouver, B. C., has directed attention to this property. It is situated near the Columbia River, in East Kootenay, and is reached by wagon road from Brisco on the Kootenay Central Ry. The ore is brought down to the bench below by a light aerial tram about 1,200 ft. long, from the lower terminal of which it is hauled over the rawhide trail for a distance of about two miles to the road.

The vein occupies a fault fissure apparently conforming in strike and dip to that of the formation. It can be traced easily for a considerable distance and is thought to be a continuation of the Lead Queen vein.

Continuing previous development the present company has uncovered the vein for a distance of about 65 ft. along the strike by a deep open cut, showing an average width of 2 ft. of ore consisting of galena associated with disseminated iron pyrites in highly siliceous gangue. A sample showed a trace of gold, silver 18.1 oz., lead 23.3 per cent, and zinc 2.4 per cent. It is said that the company mined 700 tons of ore early this year and that the returns were 5,126 oz. silver and 139,543 lb. lead. The installation of a mill is contemplated as soon as ore reserves warrant.

Trail Concentrator Treats Rossland Ore; Product Stocked

Work on the ore of the Rossland mines started recently at the Trail concentrator of the Consolidated Mining & Smelting Co. of Canada. The concentrates will be stored until sufficient has been accumulated for a run of the copper furnace at the smelter. Until the necessary tonnage is available the copper rod mill at Trail cannot be operated. If the Copper Mountain mine were to resume work the copper production would be so increased that it would be possible to open the rod mill of Trail, but of that seems little likelihood at present.

Rescue Eula Ships 300 Tons of $25 Ore From Development

The Rescue Eula has resumed shipping after a lapse of several months, and recently made a shipment to the West End mill of 300 tons of ore which will average $25 per ton. This ore is stated to be the accumulation from development workings and does not represent stoped ore. The management has stated that an energetic campaign of development is under way, and prospects for additional ore developments are good according to officials of the company.

A. S. & R. Co. Move Ore-Testing Plant to Coeur d'Alene

The American Smelter & Refining Co., is putting in a complete ore-testing plant at Wallace, Idaho, center of the Coeur d'Alene district. Ores from various sources will be tested. The plant is being shipped from southeastern Missouri, where the company has no further use for it, and will be placed in the old Standard mill in Wallace. Four technical men will have charge of the operations. Ore already has arrived in Wallace from various mines, some of them as far away as Mexico and South America, to be tested as soon as the plant is set up.

British Columbian Bauxite Mined for Use in Refining Gas

The discovery of bauxite in British Columbia has been reported on several occasions. Investigation, however, has shown that the material thus far found is not sufficiently high grade for purposes of aluminum manufacture. Recently deposits were located near Stony and Demaniel creeks, Sooke district of Vancouver Island, of such extent as to warrant their inspection by William M. Brewer, the government mining engineer. His report is to the effect that they contain a low-grade bauxite, the analyses of a representative assortment of samples indicating that the ore is so low, comparatively, in alumina and high in silica or insolubles as to obviate the possibility of it being useful for the production of aluminum. Owners of the claims, however, have found a market for the material for the refining of gas and are anticipating that with development and experimentation further commercial utilities will be discovered.

Eureka-Holly Continues Mine and Mill Construction

The Eureka-Holly Mining Co. is increasing the capacity of its mill and hoisting plant at Eureka, Nev. The shaft is now below the 600 level and sinking will continue without interruption until the 1,100-ft. point is reached. New machinery for the flotation section of the concentrator should be delivered in January, and operations are expected to begin during February.

A contract has been let to a crew of experienced shaft men. A station pump is being installed at the 600 level. No lateral work will be undertaken until the shaft has reached its definite objective at a depth of 1,100 ft.

It is hoped to open a large block, of ore-bearing limestone between the 600 and 1,100 levels. The Holly mine is equipped with two 75-hp. Y-type semi-Diesel engines, one of which operates the hoist. The other engine runs an electric generator, which supplies power for an air compressor and the mill machinery. The company has purchased a 200-hp. engine of the same type, which will be connected with a 150-kw. electric generator to furnish power for the mill. W. A. Barnes is manager.

End of Pittman Silver Purchases Cut Profits Sharply

Chief Consolidated Netted $82,613 in Third Quarter; $364,316 in Second

The Chief Consolidated Mining Co. of Eureka, Utah, mined 25,938 dry tons of ore during the third quarter for a yield of $82,613 net, compared with 43,125 tons for the second quarter, which yielded $364,318. The termination of the Pittman Act is given as the reason for the decrease. Comparing the third quarter with the second, the report shows development footage to have decreased 8,000 ft.; the average net value of the ore to have decreased, $12.05; the tonnage, 40 per cent; and the silver production, 55 per cent. Smelting, freight, and sampling charges show a reduction of $2.50. The reduction came chiefly from lower treatment charges on low-grade dry ores. The low-grade dry tonnage represents approximately 43 per cent of the total product mined. Metal production from the 25,938 dry tons mined was: 2,587 oz. gold; 655,534 oz. silver; 4,970,450 lb. lead in lead ores; 253,369 lb. copper in copper ores; 71,938 lb. lead in lead-zinc ores; 118,958 lb. zinc in zinc-lead ores.

The Grand Central mine, one of the later additions to the Chief properties, is announced to be on a paying basis, and development work toward the finding of new orebodies at the Eureka Hill and Gemini, although somewhat retarded, on account of curtailing expenses, has shown itself to be satisfactory.

The company has started grading for the new mill, construction on which will be continued through the winter. One reason for the new enterprise is that lead-treatment charges are estimated to be 100 per cent more than pre-war charges, with no likelihood that they will be reduced during the term of the present contract. The company has been working for several years in an effort to develop a metallurgical process that will successfully handle its ore. It is believed that the problem is solved.

Chance for Young Mining Graduate to Study Economics

Through the co-operation of Washington University of St. Louis, the Institute of Economics of Washington, D. C., and the U. S. Bureau of Mines, arrangements have been perfected for scholarships in mineral economics which will cover two years' work in the national capital under the technical guidance of Bureau of Mines engineers.

Each student securing one of these scholarships is to be furnished board and room, tuition to the extent of $700 a year, books and other facilities for the pursuit of the work. The scholarship is valued at $1,500, annually. The scholarships are open to graduate mining engineers who have done some work in economics. Application blanks are to be secured from E. D. Swanson, assistant to the Director of the Bureau of Mines, Washington, D. C.

Edison Buys Lithia Mine in South Dakota

Thomas A. Edison is now a mine owner. Mr. Edison admits that he has purchased the Bull Con mining property on Greyhound Gulch, in the Black Hills of South Dakota. He says he will not operate the mine at present, the purchase being for the purpose of securing a reserve supply of lithia ore, which produces the lightest known metal, lithium. This is one of the metals that is essential in some of the Edison manufacturing plants. One of his companies owns the property adjoining the Bull Con.

Wolfram Ore Found in Granite Mine in British Columbia

The Granite Mining Co. has struck what appears to be an important body of tungsten ore on its property, situated on the north bend of the Fraser River, 10 miles north of Newlands, on the Grand Trunk Pacific Railway. The discovery was made 800 ft. from the portal of the tunnel and 300 ft. below the outcrop of the vein. At the point of intersection the ore is said to be practically clean wolframite.

Iron King Opens Ore at Eureka, Utah

The ore showing on the 1,565 level of the Iron King mine, at Eureka, Utah, although of low grade, is promising, and raises are being driven 300 ft. apart on this level. Work is being retarded somewhat on account of bad air and heat, but connections are being made with the 1,300 level, and it is planned to install a fan. The work is 2,300 ft. from the shaft.

Bauxite Production Suspended at Hessen Mines in Germany

F. W. Dumont, American Consul at Frankfort-on-Main, Germany, reports that the bauxite-mining industry in Germany is at a standstill. Before the war, Germany obtained most of its bauxite from France, importing approximately 38,000 metric tons in 1913. During the war deposits in Upper Hessen were developed. The monthly output was about 1,200 tons, having an aluminum content a little under that of the French.

Peruvian Vanadium Mines Resume Shipments to U. S. A.

The vanadium mines near Casapalca, in the Peruvian Andes, which were closed down in 1921, have resumed operations, according to a report from C. E. Guyant, United States Consul at Callao. It is expected that as soon as everything is in running order there will be monthly output of approximately 1,000 tons. The ore contains from 25 to 30 per cent vanadic acid, and will be shipped to the United States for reduction.

London Letter

By W. A. Doman
Special Correspondent

London, Nov. 15—Herbert C. Miéville, who has been for some time on this side negotiating a big tin proposition in Bolivia, is leaving London today for New York. I understand the new company has a large area and is soundly backed, so that with the price of tin steadily rising (Bolivian tin commands the highest prices for the metal), the new venture, which will soon make its appearance on the London market, should have a good reception. Owing to the dislocation of business caused by the preparation for the general election, it is said that dealings in the shares will not begin until after Dec. 6.

Russo-Asiatic Puts More in Akim

It was generally thought that Leslie Urquhart had gone to South Africa to look into the possibilities of the Cam and Motor (Rhodesia) mine. I am now informed that the Russo-Asiatic Consolidated has sold the shares it had at a substantial profit, and that the probability is that another property is being investigated. Some months ago the Russo-Asiatic Consolidated took a large interest in the Akim company (West Africa), and I now understand that it has put up a further £40,000 toward the development of that company's diamond deposits. There is the possibility, too, that the Akim company will turn over its coal areas to a separate undertaking. The Russo-Asiatic still retains its interest in the gold deposits.

Share Deal Under Way

E. R. Stettinius, a partner in the firm of J. P. Morgan & Co. and a member of the New York Committee of the Anglo-American Corporation of South Africa, is now in London, and will soon leave for Paris, in which center, I understand, a big deal in these shares is being arranged. Well-informed persons in London say the shares are worth intrinsically 35s. as against the present quotation of 27s. 6d.

Good Ore at West Springs

Private advices from Johannesburg are to the effect that West Springs developments (Far East Rand) are excellent. The figures mentioned are something like the following: 67 per cent of recent development is payable, and averages 14¼ dwt. over 45¼ in. for a distance of 1,450 ft. This is certainly a good sweetener.

Dolcoath Sinks New Shaft

While, owing to the rise in the price of the metal, tin mining in Cornwall is making progress, there is still a fair amount of unemployment, and some of the skilled workers are emigrating. It is true that the great and venerable Dolcoath is resuming operations, but at present these are confined to sinking a new shaft, where fewer than 100 men are needed. Later, when this shaft can be connected up with the old workings, the position will be different.

Tin has had a jump to over £216 per ton, and companies mining this metal are expressing themselves hopefully. Many of them hitherto working at a loss are now reporting fairly substantial profits. East Pool & Agar, in Cornwall, continues to open up in a most satisfactory manner. At a depth of 1,227 ft. a drive east on the Moreing lode advanced 28 ft. has averaged 231 lb. black tin and 19 lb. wolfram per ton over a width of 6.8 ft. exposed, and a west drive has been advanced 21 ft. in ore averaging 212 lb. black tin over an exposed width of 5.7 ft. Another shoot has shown for 16 ft. 48 lb. of black tin, 33 lb. of wolfram, and 190 lb. of arsenic per ton over 5.7 ft.

Texas Sulphur Venture Doubtful

It is said that a sulphur mine in Texas has been submitted to an industrial group over here. Superficially, the report upon the property reads well, but according to rumor the group before closing handed it over to an engineer for his opinion. The engineer pointed out the weakness of average assays, and the probability is that the proposition will be turned down.

Bailey En Route to Cape

The £1 shares of the Sherwood Starr, the Rhodesian company recently introduced to the market by Sir Abe Bailey, are standing at the high price of 2¾. According to rumor the public has not taken kindly to them, and some firms of jobbers on the Stock Exchange are "stuck" with them. Sir Abe is on his way to the Cape. Holders of the shares express themselves confident that before long a price of £10 will be reached. So far the mine has opened up well, but £10 a share appears optimistic.

Iron-ore Stocks Reduced During 1923 Season

The consumption of iron ore during the season ended Nov. 1 is estimated at 62,500,000 tons, of which 58,500,000 was shipped from Lake Superior points and 3,000,000 tons is accounted for by a reduction in stocks at Lake Erie docks. This depletion of the stocks in the steel districts indicates that underground operations in the mines of Minnesota and Michigan will be active during the coming winter. It is estimated that from 15,000 to 18,000 men will be employed this winter in underground work. This ore will be placed in stockpiles awaiting the opening of the shipping season next May. Some cargoes of ore were started in November, but the season of navigation is virtually at an end.

Shipments by the Oliver Iron Mining Co., a subsidiary of the U. S. Steel Corporation, were a little in excess of 28,000,000 tons. These, as is usual, represent a little less than one-half of the total ore movement from Lake Superior. The Independent iron ore producers and shippers provide more than one-half of the ore that passes through the Lakes.

Michigan Climate Apparently Too Much for Mexican Miners

THE Mexican miners who were employed last summer by the Quincy Mining Co. to work in the copper mines in the Lake Superior district in Michigan have returned to their former homes. Apparently, the coming of cold weather didn't agree with the men from south of the Rio Grande. Quincy, however, is receiving a considerable supply of other labor, including Germans, and is steadily building up underground forces.

High Assays from Idaho Claims, in Portland Canal District

The Porter-Idaho Syndicate has been formed at Stewart, B. C., with an authorized capital of $150,000 in $10 shares, of which 840 go to the owners in payment for the property, the Idaho group, and the balance will be placed in the treasury and sold from time to time as money is needed for development. The property is situated six miles from tide-water, up the Marmot River, in the Portland Canal division. About 400 ft. of underground development has been done, opening up a 2-ft. vein for 28 ft. The ore taken out in drifting was sampled carefully in 5-ft. sections, and the five assays obtained are said to range from $227 to $395 per ton in silver and gold.

National Lead Co. Rebuilds Burned Crushing Plant

Energetic measures are being taken to hasten the reconstruction of the crushing plant of the Flat River mill of the St. Louis Smelting & Refining Co., which was destroyed by fire on Nov. 16. The plant, situated at Bonne Terre, in the southeast Missouri lead district, had just been remodeled, and revised estimates place the loss at $200,000. It is hoped to have the mine again in operation within sixty days. In the meantime approximately 800 men will be thrown out of employment.

Wallaroo & Moonta, Producer Since 1861, Considers Liquidation

The directors of the Wallaroo & Moonta mines of Australia have called a meeting of shareholders to discuss the liquidation of the company. The event is of more than passing interest, because these mines have been producing since 1861. During the year ended June 30 the company lost £77,801, and there was also a loss for the preceding year of £25,443. The low price of copper has severely decreased the earnings of the company and the heavy losses made during the last two years have almost absorbed the cash resources, and reorganization will probably have to be faced.

Washington News

By PAUL WOOTON
Special Correspondent

Pine Creek Tungsten Co. Awarded $48,748 Additional "Relief"

Company's President Avers "Moral" Claim to This Amount, and W. M. R. Commissioner Agrees

In addition to the $77,360.53 paid to the Pine Creek Tungsten Co. prior to the amendment of the War Minerals Relief Act, the Secretary of the Interior has approved an additional finding of loss of $48,748.14. This amount, in the opinion of John Briar, commissioner, "represents fairly the additional amount for which the government is morally and legally obligated." To support that opinion, he refers to the testimony of Mr. Close, who, in addition to being a mining engineer, was president of the company. He points out further that Mr. Close has been connected with the operation almost from its organization and is in a position to know. In his testimony, Mr. Close had stated that his company had a moral claim to $130,000. The amount already paid, together with the additional finding, closely approximates that sum, it is pointed out.

Capacity of Mill Increased

The claim was handled originally by Commissioner Moore. He fixed the date of stimulation as of Aug. 2, 1918. Prior to that date, the claimant company had planned the erection of a 100-ton mill. At the suggestion of the War Industries Board the plans were changed to cover the erection of a mill of 200- to 250-ton capacity.

In the application for rehearing, the company contends for an earlier date of stimulation. "A fair deduction from the record as a whole," says Commissioner Briar in his review, "is that the government was responsible for the enlarged mill and that the original purchase plan for the smaller plant was in nowise due to government influence. The exact date when government stimulation affected the claimant is hard to determine—whether on Aug. 2, as found by Commissioner Moore, or a few weeks earlier, as alleged in briefs on appeal, and in the testimony of some witnesses at the hearing. It would be fair to say, at least, that from the evidence response was not made before July 1, 1918, and that government responsibility did not begin until that date.

"It is not disputed that this is probably one of the three best tungsten properties in the country. It contains a large body of ore of such fineness that it commands at least a dollar a unit more on the market than foreign tungsten, and it is still virtually in the possession of the claimant.

"Everything considered, the salvage of $35,000 on the entire plant, as here fixed, appears fair and reasonable."

Further findings as to net loss have been approved by the Interior Secretary as follows: John F. Hafner, $370.20; Albert Loose, $1,129.30; Thomas C. Candwell, $565; F. A. Chamberlain, $226.17; Kraft and Madero, $1,589.23. In connection with the claim of Thompson Brothers Mines and of William E. Hamilton & Co., it is held that no net loss has been proved.

Oddie Will Urge Appropriation for Technical Research on Silver

Benefit to Entire Industry Is in Public Interest—Silver for Detonators and Spark-plug Points Suggested

In a letter to the Secretary of the Interior, Senator Tasker L. Oddie, of Nevada, chairman of the Senate Commission of Gold and Silver Inquiry, and slated to be the chairman of the Senate Committee on Mines and Mining, pledges his support to the appropriation which will be necessary to carry on research work on silver.

Senator Oddie advises Secretary Work that the investigation as set forth in the preliminary report of the Bureau of Mines promises to be "of great value to the silver mining industry in expanding the market for the metal." Continuing, he says:

"Whenever an entire industry may be benefited through investigational work done by the government, I believe an expenditure for such a purpose is justified fully.

"As the work progresses, other problems of investigation and research may develop, the solution of which may increase greatly the use of silver in the arts and trade. May I suggest, therefore, that in formulating a supplemental estimate for this technical research work, a surplus fund should be available at all times for the purpose of carrying the investigation into new and promising fields?"

In surveying the field for its research work, the Bureau of Mines is impressed with the possible use of silver compounds as detonators in fulminates. In addition, the high conductivity of silver suggests the possibility of its use or the use of one of its alloys for contact points on spark plugs.

Ford Starts Four New Drills in Missouri

The Henry Ford interests, prospecting in the disseminated lead district of southeast Missouri, have just placed four more diamond drills in operation. This makes six in all working on the Frank Hill tract at north Bonne Terre and on the Rodack & Weber land. Experienced drillers believe that this number is inadequate, considering the large area that must be tested.

Bismuth Found in New Iron Blossom Ore at Eureka, Utah

The new ore opened recently on the 400 level, the No. 1 shaft, at the Iron Blossom mine of Eureka, Utah, is stated to carry 2 to 3 per cent bismuth. The ores of the district usually carry bismuth, but not in commercial quantity.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	12.625	44.125	44.625	6.90	6.60@6.65	6.30
23	12.625	44.00	44.50	6.90	6.65	6.30@6.325
24	12.625	45.25	45.75	6.90	6.65	6.325
26	12.70	46.125	46.625	6.90	6.65@6.70	6.35
27	12.80	46.25	46.75	6.90	6.675@6.725	6.35@6.40
28	12.875	47.125	47.625	6.90	6.70@6.725	6.35@6.40
Av.	12.708	45.479	45.979	6.90	6.669	6 340

*These prices correspond to the following quotations for copper delivered: Nov. 22d, 23d, and 24th, 12.875c.; 26th, 12.95c.; 27th, 13.05c.; 28th, 13.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
22	60⅝	61⅜	66½	223	223½	30¼	28¼	32¾	33⅛
23	60¼	61⅛	66	222½	222¾	30¼	28½	33	33¼
26	61¼	62	66	231	231½	30½	28½	33¼	33⅜
27	62⅜	63¼	67	231¾	232½	30¾	28⅞	33⅜	33½
28	62⅝	63⅜	67½	236¾	237¼	30¾	29	33⅜	33½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Cheeks"	Silver		Gold London	Nov.	Sterling Exchange "Cheeks"	Silver		Gold London
		New York	London				New York	London	
22	4.36½	64⅛	32 15/16	93s 11d	26	4.38½	64⅓	33⅛	94s 4d
23	4.37	64¼	33	94s 5d	27	4.37	64	32 13/16	94s 1d
24	4.36¼	64½	33 3/16	.....	28	4.35¼	64⅛	33 1/16	94s 7d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Nov. 28, 1923

Copper has been inactive during the last week, but sentiment now is better than it was a week ago; lead is firmer, though inquiries have not been particularly numerous; and tin and zinc have been fairly active. Prices have shown a general tendency to advance, though tin is the only metal in which any radical change has occurred, and this was the result of manipulation.

Copper

Following a sudden lull in the demand last week after the excellent business of the preceding weeks, one or two distress lots were rumored to have been marketed at as low as 12⅞c., delivered, but no important tonnages were sold at that level. Custom refineries refused to go below 12⅞c., and this price was realized on scattering sales. On Monday sentiment was somewhat better, and 13c. was paid for several million pounds on that and the following day. This raised the price to 13⅛c., which is the lowest quotation heard today. Many producers are asking 13¼c., and some are entirely off the market at current levels, justifying their attitude by the fact that most of the buying recently has been for near-by delivery and that another buying movement may be expected soon. The advance in London has also been encouraging. There is every indication that deliveries of copper in November will be entirely satisfactory, and considerably above production. This will be an opposite condition from that prevailing in October, when stocks increased somewhat over 15,000,000 lb. Production has been slightly curtailed at some plants during November, an accident having occurred at the Baltimore refinery and temporary troubles cropping out at one or two of the South American plants; it is also reported that Wallaroo & Moonta, in Australia, has been forced to suspend operations on account of high costs and low prices for the product. This company produced about 800,000 lb. monthly.

Export business has been exceedingly quiet all week. Small amounts have been booked for England, France, Italy, and the Orient, but Germany has been out of the market.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.85c., New York. Specifications have been so good that the Smelting company has no large amount of lead available for transient customers, and outside interests have been disposed to charge at least 6.95c., though a little business was done at 6.90c. Inquiries have not been particularly numerous, but some good orders were placed at the higher levels, and for prompt delivery 7c. is probably the best price that could be done today. In the St. Louis district, producers raised prices to 6.65c. or higher on last Friday, and further advances have been made in the last two or three days. One large producer is taking a very conservative attitude in making advances, and no radical change is expected. Some of the more optimistic sellers are quoting 6.75c., today, but so far as we have heard 6.725c. is the highest price that has actually been paid.

Corroders report somewhat of a lull in their business during recent months, so that their requirements are not quite up to what they were a year ago. Battery makers seem to be taking about as much lead as ever, though, and cable manufacturers may be taking even more than usual. European demand has been sufficient to prevent any surplus accumulating, despite the fact that production increased by at least 4,000 tons last month, and further enlargement in production is being planned, especially in Missouri. No great change in demand can be anticipated in this country, so that the future of prices must depend largely on Europe.

Zinc

Zinc orders have not been large during the week, but a fair business has been done, principally with galvanizers. The demand for the higher grades of zinc, which was coincident with the better copper market of a few weeks ago, has now subsided, and the price of brass special is again about 10 points above that for Prime Western, though 15 points was paid two weeks ago. Producers do not seem to be anxious to dispose of zinc, and prices have gradually advanced, 6⅜c. being the general quotation of the last day or two. High-grade zinc continues to bring from 8 to 8½c., delivered.

Tin

Prices were suddenly advanced over the week-end by the two controlling factors in the London tin market, and there has been somewhat of a scramble to buy here on the advance, as it is thought that it may go a little further and be permanent. Consumption is, of course, exceeding production, but stocks are still sufficient to draw on for some time to come. The prices we quote for 99 per cent are only nominal, no Chinese tin nor any of the better grades of British tins being on the market. Small tonnages of German tin and of Katanga tin have been offered. Forward Straits has sold at approximately the same price as spot.

Arrivals of tin, in long tons: Nov. 22d, China, 5; 24th, Straits, 30; total to Nov. 27th, 4,180.

Foreign Exchange

Sterling has continued its wide fluctuations. On Tuesday, Nov. 27, cable quotations on francs were 5.395c.; lire, 4.3375c.; and Canadian dollars, 2 3/32 per cent discount.

Silver

In the New York market the interest in silver for San Francisco delivery has continued, although China has both bought and sold in London. India has also operated on both sides of the market abroad. There are no new factors of interest, and silver here closes quiet.

Mexican Dollars—Nov. 22d, 48⅞; 23d, 49; 24th, 49¼; 26th, 49¼; 27th, 48⅞; 28th, 48⅞.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 98 per cent, 25@26c. London, £115 per long ton.

Antimony — Chinese and Japanese brands 8⅞@9c. W.C.C. brand, 9½@10c. Cookson's "C" grade, 11½@12c. Chinese needle antimony, lump, nominal, 6.50c. per lb. Standard powdered needle antimony (200 mesh), 7@8c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.50@8c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—75c. per lb. London, 2s. 6d.

Cobalt—$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£130 long ton.

Palladium—$83 per oz.

Platinum—$125 per oz. London, £29.

Quicksilver — $62 per 75-lb. flask. Quiet. San Francisco wires $60.35. London, £9 15s.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given Nov. 3.

Metallic Ores

Manganese—Brazilian, 40c. and Caucasian, 42c. per unit. Nominal.

Chrome—$19.25 per ton. Nominal.

Tungsten Ore—High-grade wolframite, $9; high-grade scheelite, $9.50@$10 per unit. Ordinary grades, $8@$8.25.

Iron Ore, Magnetite, Molybdenum, Titanium, Vanadium, and **Zircon Ore** are unchanged from the quotations published Nov. 3.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 24—Zinc blende, per ton, high, $42.75; basis 60 per cent zinc, premium, $41@$41.50; Prime Western, $40.50; fines and slimes, $39 @$37.50; average settling price, all zinc ore, $41.20.

Lead, high, $83.65; basis 80 per cent lead, $81@$82; average settling price, all lead ore, $82.78 per ton.

Shipments for the week: Blende, 15,601; lead, 1,877 tons. Value, all ores the week, $798,190. Total shipments for eleven months: Blende, 606,340; calamine, 3,100; lead, 75,582 tons. Value, all ores eleven months, $32,569,900.

Zinc prices were $1 lower on all grades, and lead was $1 to $2 higher. Zinc purchases for the week were 13,250 tons, and for November 57,000 tons. Weather the entire month has been exceptionally fine for the season, with some rain but no severe cold, and with little freezing temperature.

Platteville, Wis., Nov. 24.—Blende, basis 60 per cent zinc, $43.50 per ton. Lead, basis 80 per cent lead, $70 per ton. Shipments for the week: Blende, 561 tons; lead, 30 tons. Shipments for the year: Blende, 28,825; lead 720 tons. Shipments for the week to separating plants: 1,332 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $350@$450; No. 2, $200@$250; spinning fibers, $100@$125; magnesia and compressed sheet fibers, $60@$90; shingle stock, $50@$65; paper stock, $30@$40; cement stock, $17@$20; floats, $6@$12. All f.o.b. mines, per short ton, Quebec.

Graphite—Amorphous grades, $15@$35 per ton, f.o.b. New York. For Ceylon grades see issue of Nov. 3.

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc and **Tripoli** are unchanged from the Nov. 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—13½c. per lb.

Copper Sulphate—4.90@5c. per lb., domestic product.

Potassium Sulphate, Sodium Nitrate, and **Sodium Sulphate** are unchanged from quotations of Nov. 3.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, generally obtainable at $110 per gross ton, f.o.b. works. Spiegeleisen, 19@21 per cent, $38@$40; 16@19 per cent, $38.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices published Nov. 3.

Metal Products

Copper—Sheets, 21c. base; wire, 15¾c.

Lead Sheets—Cut, 10.50c.; full, 10.25c. per lb.

Nickel Silver—18 per cent Grade A sheets, 28c.

Yellow Metal — **Dimension sheets,** 18.75c.; rods, 15.75c.

Zinc Sheets—Base price, $9.25 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the Nov. 3 prices.

The Iron Trade

Pittsburgh, Nov. 27, 1923

Buying of finished-steel products continues to taper off, this being probably accounted for by the season of year. Though production and deliveries of steel decrease, consumers are liquidating stocks when they have stocks, and thus consumption is plainly at a high rate.

In the last fortnight steel-ingot production has been at about 20 per cent below the peak rate of last April and about 20 per cent above the average rate 1919 to 1922 inclusive. Further decreases to the end of the year are expected. Should a buying movement develop in December, as was the case a year ago, production would hardly be affected until after Jan. 1.

Finished-steel prices are holding well, but in most lines the individual inquiries are so small as to afford little real test of strength.

Pig Iron—In some districts the buying movement of the last fortnight was helped by slight further price concessions, and prices in general are now showing a stiffening tendency. The local market is not a large foundry iron market, but has shown activity proportionate to that in other districts. Steelmaking iron has been quiet: Bessemer, $23; basic, $20; foundry, $21, f.o.b. Valley furnaces.

Connellsville Coke—Odd lots of furnace are being cleaned up and the market is now steady at $4, with foundry remaining at $5@$5.50.

Zinc Market Partly Supported by Europe

Purchases From Abroad Have Been an Important Factor in Sales Made During the Year

By Felix Edgar Wormser
Assistant Editor

SO FAR as slab zinc is concerned, the year which is soon to draw to a close will be the best of the last three. Not that 1923 will be a big improvement over 1922, for it is unsatisfactory from the standpoint of prices, but 1921 was relatively poor (average yearly price 4.655c.), 1922 was slightly better (average price 5.716c.), and 1923 will probably average well over 6c. per lb. This, of course, is small consolation for producers burdened with high fuel, labor, and material costs and who desire a price of slab zinc in harmony with the general commodity price level. However, it denotes some progress. Fluctuations in prices, especially during the last three months, have been within narrow limits. Since Sept. 1, Prime Western slab zinc has sold for as high as 6.55c. per lb.; at another time as low as 6.20c. It is noticeable that lately the zinc market usually has encountered some resistance in a downward movement when quotations have reached about 6.20c. per lb. Prices have not dropped below that figure. Why this should be so is largely a matter of conjecture, but it seems that speculative buying in Europe and the United States on the strength of the general zinc position is encouraged when the 6.20c. level is crossed. Metal in hands weak financially is taken up by dealers who have confidence in the soundness of the market. But, regardless of the reason, it must be gratifying for both producers and consumers to have slab zinc prices move slowly in either direction.

The Position of the Smelters

Despite the protestations of the smelters that they are unable to smelt profitably Joplin ores at, say, $40 in a 6.50c. zinc market and corresponding prices at other market levels, they continue to purchase concentrates and to maintain production. Perhaps smelters are willing to take a small loss rather than shut down completely and thereby take a heavier one. This would mean that the difference between the price of ore that is profitable to the smelter to treat, and the price of ore that permits smelting operations only at a small loss, is one that works in favor of the miners. A shutdown is costly and is decided upon only as a last resort by any mining or smelting company under adverse business conditions.

Data on Zinc Production and Shipments for the First Ten Months of 1923

Figures in Short Tons

1923	Smelter Production	Shipments	Stocks on Hand at End of Month	Retorts Operating	Export Shipments	Average Price in Cents per Pound East St. Louis
Jan.	46,317	47,995	16,574	84,131	7,954	6.815
Feb.	42,443	48,153	10,864	86,931	2,636	7.152
March	48,731	49,574	10,021	89,054	3,092	7.706
April	46,866	47,911	8,976	89,203	818	7.197
May	47,347	43,304	13,019	86,731	308	6.625
June	42,840	38,686	17,173	84,455	560	6.031
July	43,065	38,998	21,240	82,075	185	6.089
Aug.	41,625	36,394	26,471	75,325	1,016	6.325
Sept.	39,105	42,683	22,893	81,849	8,167	6.438
Oct.	42,098	39,204	25,787	84,559	6,978	6.293

Owing to the excellent monthly statistical records kept by the American Zinc Institute, an accurate picture of the American zinc industry's activities may be had promptly at the middle of each month. The record is made public without fear or favor. The results for October show that the number of retorts at the smelting plants in operation was 84,559 at the end of the month, an increase of 2,710 retorts over the previous month. This increase occurs just at a time when the cry is for lower production. As a matter of fact, many miners have made an attempt at curtailment—that is, they have shut down for part of each month, but so far their action has not had much reflection in smelter production figures. It does not take so long for zinc concentrates to pass through the smelter as it does copper ores. Smelter output is now about 42,000 tons per month, or at the rate of over 500,000 tons per annum—the highest rate since 1918, which was a war year. Production before the war was approximately 350,000 tons annually. It would appear that curtailment of production as practised at present in the Middle West has not had much effect and requires severer measures by miners and smelters before it will.

European Market a Big Advantage

Of course, there has been an element in the slab zinc market normally absent from it—a factor of great importance, nevertheless—export sales of slab zinc to Europe. For the first ten months of this year 31,700 tons of American made slab zinc was shipped from smelting plants to foreign consumers. This metal is shipped by rail down the Mississippi to Gulf ports and thence by steamer to destination. Ordinarily the American zinc industry does not export much of its production. In fact, it is fearful of foreign competition, and demands a tariff for protection against it. But in 1923, owing to the disturbed political condition abroad and in some of the world's most important zinc-producing countries, American slab zinc has been called upon to make up the deficit in the production of these harassed countries. For example, the supply of zinc from Upper Silesia has been seriously affected as a consequence of political and labor troubles. Zinc from that region formerly filled a large portion of the Continental requirements. The dearth of metal abroad has now brought about the unusual situation of American zinc smelters shipping part of their output to Europe. Furthermore, the situation is expected to continue, as the causes bringing it about are still at work. The barometer governing the marketing of zinc abroad is the difference between the London and American seaboard quotations reduced to a common denominator and allowing for shipping charges. Hence the London quotations are now watched even more closely than usual.

One can readily imagine what would have happened to the domestic market had this support from European sources been lacking during the year. In any market it is the relatively small surplus of production over consumption which principally determines the price of any commodity. Without purchases from Europe, the surplus of production over consumption would have been too great for comfort and prices of slab zinc would have been depressed unless some compensating force had been introduced. There were times when the zinc market was headed downward, only to be saved by the materialization of export business.

High-Grade Zinc Market Exceptional

Although the market for Prime Western zinc has not been satisfactory to the vast majority of producers, the market for high grade has generally been splendid. High grade is the purest product of the producers, and commands a premium of from one to two cents per pound over the price of Prime Western. The domestic market at present is being supplied principally by two large zinc-producing companies, the New Jersey Zinc Co. and the Anaconda Copper Mining Co. The former produces its high grade from pure ores by fire methods; the latter derives its production chiefly from Montana ores by electrolytic methods. Movements in the price of high grade are slow in taking effect, and although they are dependent primarily upon the price of Prime Western, are not nearly so sensitive to any change in market conditions. High-grade zinc is used by the manufacturers of the finest brasses and other alloys of zinc and by rolling mills turning out sheets.

Company Reports

Callahan Zinc-Lead Co.

A report of operations of the Callahan Zinc-Lead Co. for the third quarter of the year 1923 follows:

Net value of shipments	$280,749.30
Miscellaneous income	15,320.21
Total income	$296,069.51
Production costs, expenses, development, etc.	272,158.54
Operating profit	$23,910.97
Improvements and new equipment	10,692.36
Surplus for the period	$13,218.61

The principal features of the mining and milling operations during the quarter were as follows:

Tonnage mined		47,651
Tons of mine ore milled		32,493
Tons of tailings milled		21,732
Average contents of mill feed:	Zinc, per cent	10.45
	Lead, per cent	3.74
	Silver, oz.	1.31

Shipments	Dry Tons	Zinc Assay, Per Cent	Pounds Zinc	Lead Assay, Per Cent	Pounds Lead
Lead concentrates	1,954	15.82	618,264	55.81	2,181,081
Zinc concentrates	9,791	51.23	10,031,755	5.06	990,859
	11,745		10,650,019		3,171,940

Ounces of silver in lead concentrates	36,842
Mill recovery of zinc, per cent	93.93
Cost of mining, crushing and sorting, per ton mined	$2.806
Cost of milling and flotation royalties, per ton milled	$1.584

Although shipments of zinc and lead-silver concentrates during the third quarter exceeded shipments in the previous period by 2,129 dry tons, the net value of the increased shipments in the September quarter was only $280,749.30, compared with $282,775.09 in the second quarter. Average prices obtained were: Zinc, 6.34c. per lb.; lead, 6.53c. per lb., and silver, 63.4c. an oz., which compares with 6.19c., 7.52c. and 85.3c. for zinc, lead and silver, respectively, in the second quarter.

Total income of $296,069.51 compares with $303,506.99 for the previous quarter, and operating costs were reduced to $272,158.54, compared with $331,878.76 in the second quarter. Lower operating costs and higher efficiency are reflected in a surplus of $13,218.61 for the period, which compares with a deficit of $42,666.72 for the second quarter.

The greatly increased efficiency of the mill is gratifying to the management. Mill recoveries of zinc during the past quarter were higher than at any other time in the company's history. Recoveries of 93.93 per cent during the third quarter compare with 83.22 per cent in the previous quarter, and 71.01 per cent during the severe winter months of the first quarter. Mill feed in the third quarter was the lowest on record, and reflects the quality of the ore in the lower levels of the mine.

With present low-grade ore reserves, and the probability of conducting operations at a loss during the severe winter months, when mill recoveries are seriously impaired, the directors ordered a suspension of shipments on Oct. 1, pending the result of the development work now being prosecuted at both the Callahan and Galena properties. The long crosscut on the No. 4 level of the Callahan property has been driven 2,100 ft. from the main tunnel, and the drift on the No. 6 tunnel level in the Galena property is in 2,500 ft. The cost of this development work is being charged to general operating costs, and will be continued through the winter months.

The report states that the company continues in excellent financial condition, with current assets in ratio of 20 to 1 over current liabilities. Cash and high-grade investment bonds total $1,117,000, with no indebtedness aside from current accounts payable amounting to $56,000.

Chino Copper Co.

Copper; Hurley, New Mexico

A report of the operations of the Chino Copper Co. for the third quarter of the current fiscal and calendar year states that four regular sections of the mill at Hurley, out of a total of seven, together with the ball mills in the fine-grinding section, were in operation during the quarter.

The total amount of ore treated for the quarter was 737,609 dry tons, an average of 8,017 tons per day, the average grade being 1.48 per cent copper. The comparative figures for the preceding quarter were 7,827 tons per day, containing an average of 1.41 per cent copper. The average gross recovery of copper contained in the concentrates was 18.46 lb. per ton of ore treated, compared to 17.82 lb. for the previous quarter.

In addition to the copper produced from mill operations, 9,229 tons of crude ore was shipped direct to the smelter, containing an average of 4.35 per cent copper.

The net production of refined copper from all sources, after allowing for smelter deductions, was 13,757,690 lb., as stated below, compared to 12,416,022 lb. for the preceding quarter and 13,356,764 lb. for the first quarter:

Third Quarter, 1923	Pounds	Second Quarter, 1923	Pounds	First Quarter, 1923	Pounds
July	5,716,379	April	3,880,694	January	4,440,237
August	4,202,636	May	4,539,540	February	3,768,330
September	3,838,675	June	3,995,788	March	5,148,197
Total	13,757,690		12,416,022		13,356,764
Average monthly production	4,585,897		4,138,674		4,452,255

The cost per pound of net copper produced from all sources was 14c., compared with 13.95c. for the quarter ended June 30, 1923. These costs include all operating and general charges of every kind except depreciation, and also include credit for gold and silver values and miscellaneous revenues.

The following tabulation shows the financial result of operations, exclusive of depreciation:

	Third Quarter, 1923	Second Quarter, 1923	First Quarter, 1923
Operating gain	$44,551.60	$201,698.24	$388,752.46
Miscellaneous revenue, including precious metals	81,546.16	53,378.95	16,859.48
Operating gain for quarter	$126,097.76	$255,077.19	$405,611.84

The above figures are based on an average of 14.915c. per lb. of copper, compared with 16.006c. for the quarter ended June 30, 1923.

General conditions at the mines continued to improve, notwithstanding delays in delivery of much-needed equipment, most of which it is now expected will arrive during the last quarter.

Toward the end of the quarter a part of two sections of the new concentrating equipment began operations, with highly satisfactory results, in that recoveries were from three to four pounds of copper per ton of ore greater in the new arrangement than in the old. This improvement did not apply to sufficient extent greatly to affect general mill recoveries for this quarter, but will do so increasingly from now on as betterments progress.

Iron Cap Copper Co.

Copper; Globe, Ariz.

A bulletin of the Iron Cap Copper Co. states that during the third quarter of 1923 the production was 1,549,306 lb. of copper, 20,427 oz. of silver, and 182 oz. of gold. A condensed financial statement follows:

Income for the quarter	$169,817.89
Expenses for the quarter	160,660.31
Profit	$9,157.58

The bulletin gives the information that there has been slight difference in the monthly rate of production, and the decline in earnings from those of the last quarter is because of the lower prices for copper and silver.

MINING STOCKS

Week Ended November 24, 1923

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Ahmeek	Boston	...	...	58	June 23, Q $1.50
Alaska-Br. Col.	N. Y. Curb	*85	*81	*81	...
Allouez	Boston	...	...	*16	Mar. '19 1.00
Anaconda	New York	38½	36¾	37¾	Se. 15, Oc. 22, Q 0.75
Arcadian Consol.	Boston	2⅜	2	2	...
Ariz. Com'l.	Boston	8½	8	8	July '23, 0.50
Calaveras	N. Y. Curb	...	...	2¼	...
Calumet & Arizona	Boston	47	43	43	De. 7, De. 24, Q 0.50
Cal. & Hecla (New)	Boston	20½	18¾	20⅜	De. 1, De. 17 0.50
Centennial	Boston	...	...	7	Dec. '18, SA 1.00
Cerro de Pasco	New York	43⅜	40½	42⅛	Oc. 18, No. 1, Q 1.00
Chile Copper	New York	27¾	27	27⅛	De. 1, De. 29, Q 0.62½
Chino	New York	17⅞	16½	16⅝	Sept. '20, Q 0.37½
Con. Cop. Min. (New)	N. Y. Curb	1⅛	1⅛	1⅛	...
Copper Range	Boston	26½	24½	24½	May '23, Q 1.00
Crystal Copper	Boston Curb	72	65	68	...
Davis-Daly	Boston	4½	3½	3½	Mar. '20, Q 0.25
East Butte	Boston	5⅜	5⅛	5⅛	Dec. '19, A 0.50
First National	Boston Curb	30	26	28	Feb. '19, SA 0.15
Franklin	Boston	1⅛	1⅛	1⅛	...
Gadsden Copper	Boston Curb	*45	*43	*45	...
Granby Consol.	New York	15½	14½	14½	May '19, Q 1.25
Greene-Cananea	New York	15½	15	15½	Nov. '20, Q 0.50
Hancock	Boston	1½	1½	1½	...
Howe Sound	N. Y. Curb	2⅞	2⅞	2⅞	Oc. 1, Oc. 15 0.05
Inspiration Consol.	New York	28	26½	26⅜	De. 20, Ja. 7, Q 0.50
Iron Cap	Boston Curb	4	4	4	May 23, K 0.15
Isle Royale	Boston	20½	20	20⅛	Se. 1, Se. 15, 0.50
Kennecott	New York	35	33½	34¼	De. 7, Ja. 2, Q 0.75
Keweenaw	Boston	*80	*80	*80	...
Lake Copper	Boston	1⅜	1⅛	1⅜	...
Magma Copper	New York	30½	29½	30	Jan. '19, Q 0.50
Mason Valley	N. Y. Curb	1¼	1¼	1¼	...
Mass Consolidated	Boston	1½	1	1	Nov. '17, Q 1.00
Miami Copper	New York	22⅛	22	22	No. 1, No. 15, Q 0.50
Michigan	Boston	1⅛	1⅛	1⅛	...
Mohawk	Boston	*34½	*33	*33½	Se. 22, Oc. 13, 1.00
Mother Lode Coa.	New York	9⅛	8⅞	9	De. 14, De. 31 0.50
Nevada Consol.	New York	12⅛	11⅜	12	Sept. '20, Q 0.25
New Cornelia	Boston	*16½	*15½	*16	Au. 3, Au. 20, Q 0.25
New Dominion	N. Y. Curb	2⅛	2⅛	2⅛	...
North Butte	Boston	2⅛	2⅛	2⅛	Oct. '18, Q 0.25
Ohio Copper	N. Y. Curb	*90	*83	*87	...
Old Dominion	Boston	17¼	16½	17⅛	Dec. '18, Q 1.00
Osceola	Boston	...	...	31½	June '23, Q 1.00
Phelps Dodge	Open Mar.	†150	†135	...	Se. 20, Oc. 2 Q 1.00
Quincy	Boston	23½	22	22½	Mar. '20, Q 1.00
Ray Consolidated	New York	12⅜	12	12	Dec. '20, Q 0.25
Ray Hercules	N. Y. Curb	*40	*25	*40	...
St. Mary's Min. Ld.	Boston	*33	*32	*33	No. 9, De. 11, K 1.00
Seneca Copper	New York	6¼	5⅜	6	...
Shannon	Boston	*50	*40	*40	Nov. '17, Q 0.25
Shattuck Arizona	New York	6½	6½	6½	Jan. '20, Q 0.25
South Lake	Boston	¼	¼	¼	...
Superior & Boston	Boston	1⅜	1⅛	1⅛	...
Tenn. C. & C. cfs.	New York	9⅛	8⅝	8⅞	Se. 29, Oc. 15, Q 0.25
Tuolumne	Boston	*60	*40	*42	May '13, 0.10
United Verde Ex.	N. Y. Curb	27½	27	27	Oc. 5, No. 1, Q 1.00
Utah Consol.	Boston	*65	*50	*60	Sept '18, 0.25
Utah Copper	New York	65	61½	63⅞	Se. 14, Se. 29, Q 1.00
Utah Metal & T.	Boston	*45	*40	*40	Dec. '17, 0.30
Victoria	Boston	...	...	1⅛	...
Winona	Boston	*25	*25	*25	...
Wolverine	Boston	5⅛	5⅛	5⅛	...
NICKEL-COPPER					
Internat. Nickel	New York	12⅛	11⅛	11⅜	Mar.' 19, 0.50
Internat. Nickel pfd.	New York	81	81	81	Oc. 11, No. 1 Q. 1.50
LEAD					
Ahumada	Boston Curb	5⅛	5⅛	5⅛	...
Carnegie Lead & Zinc	Pittsburgh	2⅛	1	2⅛	...
National Lead	New York	128¼	124	125⅛	De. 14, De. 31, Q 2.00
National Lead pfd.	New York	112½	112	112	Au. 24, Se. 15 Q 1.75
St. Joseph Lead	New York	21	20	21	Se. 9, Se. 20 Q, X 0.50
ZINC					
Am. Z. L. & S.	New York	8⅛	7	8⅛	May '20, 1.00
Am. Z. L. & S. pfd.	New York	30	29½	30	Nov. '20, Q 1.50
Butte C. & Z.	New York	5⅜	5⅛	5⅜	Mar. '23, 0.50
Butte & Superior	New York	16⅛	14⅝	16	Je. 15, Je. 30, Q 0.50
Callahan Zn-Ld	New York	5¼	4	5⅛	Dec. '20, Q 0.50
New Jersey Zn.	N. Y. Curb	151	146⅛	150	Oc. 31, No. 10, Q 2.00
United Zinc	N. Y. Curb	...	...	*50	...
Yellow Pine	Los Angeles	*70	*70	*70	June '23, Q 0.03
SILVER					
Alvarado	N. Y. Curb	2⅛	2⅛	2⅛	...
Batopilas Mining	New York	...	...	⅛	Dec. '07, I 0.12½
Beaver Consol.	Toronto	*23	*23	*23	May '20, K 0.03
Candelaria	N. Y. Curb	*5	*4	*5	...
Castle-Trethewey	Toronto	*41	*39½	*41	...
Coniagas	Toronto	2.05	2.05	2.05	Oc. 19, No. 1, '23 0.02½
Crown Reserve	Toronto	*66	*62	*65	Jan. 17, 0.05
Kerr Lake	N. Y. Curb	...	...	2⅛	Oc. 1, Oc. 15, Q 0 12½
La Rose	Toronto	...	...	*24	Apr. '22, 0.10
McKinley-Dar.-Sav.	Toronto	*15½	*14	*15	Oct. '20, Q 0.03
Mining Corp. Can.	Toronto	2.89	2.74	2.75	Sept. '20, Q 0.12½
Nipissing	N. Y. Curb	5⅞	5⅛	5⅞	Se. 3, Oc. 17. Q 0.30
Ontario Silver	New York	...	...	6½	Jan. '19, Q 0.50
Temiskaming	Toronto	*32½	*32	*32½	Jan. '20, K 0.04

Stock	Exch.	High	Low	Last	Last Div.
GOLD					
Alaska Gold	New York	⅛	⅛	⅛	...
Alaska Juneau	New York	1	⅛	⅛	...
Boundary Red M.	N. Y. Curb	...	...	*12	...
Carson Hill	Boston	4⅛	3⅛	3⅛	...
Cresson Consol. G.	N. Y. Curb	3½	3½	3½	Se. 30, Oc. 10, Q 0.10
Dome Mines	New York	18½	18	18½	De. 31, Ja. 2, Q 0.50
Golden Cycle	Colo. Springs	1.10	1.10	1.10	Dec. '22, Q 0.02
Hollinger Consol.	Toronto	11.45	11.35	11.45	No. 15, De. 3, 0.05
Homestake Mining	New York	60½	60½	60½	No. 20, No. 26 M 0.50
Kirkland Lake	Toronto	*32	*31	*31½	...
Lake Shore	Toronto	3.57	3.51	3.52	No. 1, No. 15'23Q 0.02
McIntyre-Porcupine	New York	16½	16½	16½	De. 1, Ja. 2, 0.25
Portland	Colo. Springs	*30	*30	*30	Oct. '20, Q 0.01
Teck-Hughes	N. Y. Curb	1⅛	1⅛	1⅛	...
Tom Reed	Los Angeles	*62	*53½	*60	Dec. '19, 0.02
United Eastern	N. Y. Curb	1½	1 1/16	1⅛	Oc. 8, Oc. 28, Q 0.15
Vipond Cons.	Toronto	*92	*91	*91	...
Wright-Hargreaves	Toronto	3.15	3.00	3.15	Se. 15, Oc. 1, Q 0.02½
Yukon Gold	N. Y. Curb	*72	*60	*60	June '18, 0.02½
GOLD AND SILVER					
Boston-Mont. Corp.	N. Y. Curb	*23	*18	*22	...
Con. Cortez	N. Y. Curb	*52	*48	*52	...
Con. Virginia	San Francisco	9⅛	8⅛	8⅛	...
Continental Mines	N. Y. Curb	4⅛	4⅛	4⅛	...
Dolores Esperanza	N. Y. Curb	*85	*85	*85	Jy. 1, Jy. 10 Q 0.05
Jib Consol.	N. Y. Curb	...	...	*65	...
Tonopah Belmont	N. Y. Curb	*38	*38	*38	Apr. '23, Q 0.05
Tonopah Divide	N. Y. Curb	*49	*49	*49	Se. 22, Oc. 10 0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	De. 11, Ja. 1 0.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1⅛	Se. 30, Oc. 1 0.07½
Unity Gold	N. Y. Curb	3⅛	3	3⅛	...
West End Consol.	N. Y. Curb	*68	*68	*68	Mar. '23, Q 0.05
SILVER-LEAD					
Bingham Mines	Boston	17	17	17	Sept. 19, Q 0.25
Cardiff M. & M.	Salt Lake	90	84	*89	Dec. '20, 0.15
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Oc. 10, No. 1, Q 0.10
Columbus Rexall	Salt Lake	*25	*25	*25	Aug. '22, 0.03
Consol. M. & S.	Montreal	26⅛	25⅛	26⅛	Oct. '20, Q 0.62½
Erupcion	Boston Curb	1⅛	1⅛	2⅛	Se. 15, Oc. 2 0.125
Federal M. & S.	New York	11⅛	11⅛	11⅛	Jan., '09, 1.50
Federal M. & S. pfd.	New York	45⅛	44	45	No. 26, De. 15, 1.75
Florence Silver	Spokane	*13⅛	*11	*11	Apr. '19, Q, X 0.01
Hecla Mining	N. Y. Curb	8⅛	8⅛	8⅛	Au. 15, Se. 15 0.15½
Iron Blossom Con.	N. Y. Curb	*32	*32	*32	Oct. 25, '23, 0.02
Marsh Mines	N. Y. Curb	...	...	*11	June '21, I 0.02½
Park City	Salt Lake	4.02½	3.80	4.00	Se. 15, Oc. 1 Q 0.12
Park Utah	N. Y. Curb	....	....	3	Se. 15, Oc. 1 Q 0.15½
Prince Consol.	Salt Lake	...	...	*75	Nov. '17, 0.02
Silversmith	Spokane	*34	*33½	*33½	Oc. 1, Oc. 10 0.01
Simon Silver-Lead	N. Y. Curb	*4	*3	*3	...
Snowstorm Silver-L.	N. Y. Curb	...	...	*46	...
Tamarack-Custer	Spokane	1.40	1.35	1.40	Se. 30, Oc. 1, K 0.02
Tintic Standard	Salt Lake	3.85	3.57½	3.85	Se. 24, Se. 29 0.15
Utah-Apex	Boston	2⅞	2½	2⅝	June '23, Q, X 0.50
IRON					
Bethlehem Steel	New York	55½	49	54⅜	De. 1, Ja. 2, Q 1.25
Char. Iron	Detroit	⅛	⅛	⅛	...
Char. Iron pfd.	Detroit	1⅛	1⅛	1⅛	...
Colorado Fuel & Iron	New York	25⅛	23	25⅛	No. 10, No. 26 Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb. '23, Q 2.00
Gt. North'n Iron Ore	New York	32⅞	30⅛	32⅛	Apr. '23 1.00
Inland Steel	N. Y. Curb	...	...	46	No. 15, De. 1Q 0.62½
Mesabi Iron	N. Y. Curb	...	...	5	...
Replogle Steel	New York	12⅜	10	12⅛	...
Republic I. & S.	New York	49⅞	45½	49	May '21 1.50
Republic I. S. pfd.	New York	92⅛	91⅓	92	De. 15, Ja. 2 Q 1.75
Sloss-Sheffield S. & I.	New York	54½	49	53⅓	Feb. '21, 1.50
Sloss-Shef. S. & I. pfd.	New York	81⅛	81⅛	81⅛	De. 20, Ja. 2, Q 1.75
U. S. Steel	New York	96⅞	92⅛	95⅞	No. 29, De. 29, Q 1.50
U. S. Steel pfd.	New York	119⅛	118⅛	119	No. 4, No. 28, Q 1.75
Virginia I. C. & C.	New York	54	54	54	De. 15, Ja. 2 1.50
Virginia I. C. & C. pfd.	New York	...	...	81	De. 15, Ja. 22 2.50
VANADIUM					
Vanadium Corp.	New York	31⅛	28½	30¾	Jan. '21, Q 1.00
ASBESTOS					
Asbestos Corp.	Montreal	27	26	27	Se. 29, Oc. 15 Q 1.00
Asbestos Corp. pfd.	Montreal	60	58	60	Se. 29, Oc. 15 Q 1.50
SULPHUR					
Freeport Texas	New York	12⅛	11	12	Nov. '19, Q 1.00
Texas Gulf	New York	62	60⅞	60⅞	De. 1, De. 15 QX 2.00
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛	...
MINING, SMELTING AND REFINING					
Amer. Metal	New York	44½	44	44½	No. 17, De. 1, Q 0.75
Amer. Metal pfd.	New York	...	...	110	No. 19, De 1, Q 1.75
Amer. Sm. & Ref.	New York	60	57⅛	58⅛	Oc. 11, No. 1, Q 1.25
Amer. Sm. & Ref. pfd	New York	96	94½	95⅛	No. 9, De. 1, 1.75
U. S. Sm. R. & M.	New York	21⅛	20½	21⅛	Jan. '21, Q 0.50
U.S. Sm.R.& M. pfd.	New York	...	...	40	Oc. 8, Oc. 15, Q 0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

Illuminating Device for the Microscope

Facilitates Examinations and Photographing of Opaque Objects

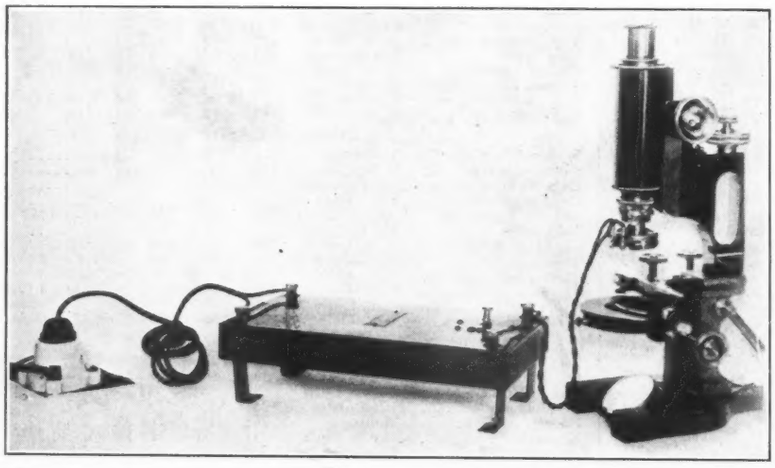
An interesting device intended for use in microscopic examinations and photographing of opaque objects is made by a Chicago manufacturer. The examination and photography of metallic specimens is particularly aided by it, and it is claimed that several users have been impressed with the depth of penetration of the light without interfering shadow effects in the examination of surface cracks and on the power of the device to light up the interior of small pores and slag pits on the surface of specimens.

In principle the device consists of a circular source of light surrounding the objective and furnishing a diffused and uniform illumination at the place where needed. In practice, the circular source of light takes the form of a small, circular-tube electric lamp held in place around the objective by means of a holder, the proper current being supplied from the electrical-lighting circuit through a rheostat. Dry cells or a storage battery may be used. The holder is provided with three spring-controlled iris-like fingers which clamp it to the objective of the microscope. A shutter slips inside the lamp and cuts the illumination off one-half of the field and casts shadows where they prove desirable. The absorption disk, which is a blackened disk with a small hole in the center, covers the object and prevents external glare when the operator of a monocular microscope keeps both eyes open.

It is claimed that more detail is obtained with this illuminator than is possible with the vertical illuminator. The intensity of the light is much lower when using this device, and yet the observer sees more, because there is no excess useless light to cause the pupil of the eye to contract and diminish its visual power. As a consequence, eye strain and eye fatigue, with resulting brain fag, are eliminated.

Objects to be photographed are placed on the stage in the usual way. The light intensity and quality are such that a camera without shutter or lenses may be attached to the tube of the microscope. With a 10X eye piece and 16 mm. or 32 mm. objective, an exposure of 20 seconds is usually sufficient.

This device is manufactured by the Central Scientific Co., 460 East Ohio St., Chicago, Ill.



The illuminating outfit connected to a lamp socket and ready for use

INDUSTRIAL NOTES

D. C. Gates has been appointed manager of the machinery department of the Mine & Smelter Supply Co., thus returning to the company after an absence of seven years. He comes from the Plains Iron Works, of Denver, where he has been manager since 1916.

W. A. Leddell, formerly with the Hardinge company as sales engineer, representing them in Mexico and the Southwest, is now with the Stearns Roger Manufacturing Co., builders and contractors of mining and metallurgical machinery and plants. His headquarters will be in Denver, but he will cover the same territory as before.

The Philadelphia division of the B. F. Sturtevant Company is now located at Thorne and Copewood Streets, Camden, N. J. An up-to-date shop for making sheet-metal work required for fan systems will be maintained. Guards for machines, pulleys, and gears will also be manufactured.

TRADE CATALOGS

A Unique Catalog

To Joseph T. Ryerson & Son, Inc., Buffalo, N. Y., belongs the credit for getting out a trade catalog that is unique in that it combines an interesting editorial section with its list of supplies. The copy just received is the November-December issue of the "Ryerson Journal and Stock List," which contains 128 pages. The issue includes a résumé of the steel market by Gilbert L. Lacher, western editor of *The Iron Age*. In all, this editorial section comprises thirty pages.

Cranes—"Man-Power Multiplied" is the title of the twenty-page "Booklet No. 10" just issued by the Brown Hoisting Machinery Co., of Cleveland, Ohio. It contains a detailed description of the Brownhoist No. 2 locomotive crane, with ample illustrations.

Steam Shovels—Bulletin 308 of the Marion Steam Shovel Co., Marion, Ohio, describes the company's 1½-yd. revolving steam shovel.

Flexible Couplings—The De Laval Steam Turbine Co., Trenton, N. J., has issued a twelve-page catalog describing the De Laval flexible coupling. This coupling, which has been developed for turbines or other motors geared or direct-coupled to pumps, generators, and similar machinery, consists of two opposed flanges mounted on the driving and driven shafts respectively. One flange carries bolts or pins which enter holes bored in the opposing flange, but not coming into metallic contact with the latter, as the driving force is transmitted through steel lined molded rubber bushings slipped over the pins. The rubber supplies the flexibility required to take care of inevitable slight misalignment, does not require lubrication and absorbs shocks. There is no constraint upon independent endwise motion of the shafts and one shaft can be removed without disturbing the other.

Car Dumper—Bulletin No. 78 of the Wellman-Seaver-Morgan Co., of Cleveland, describes the W-S-M revolving car dumper, which is the latest development in this type of equipment. This dumper has been developed to meet the demand for a low-capacity machine, of simple construction and adaptable to plants where installation cost is an important factor. It will handle all sizes and capacities of open-top railroad cars. A clamping arrangement is provided, which automatically adjusts the machine to the size of the car. In operation a car is placed in the machine and inverted by means of a control lever, discharging its contents into the bin beneath. It is then returned to its original position by turning the control lever in the opposite direction. Except for the revolving operation, all the functions are automatic.